CONSEIL PERMANENT INTERNATIONAL POUR
L'EXPLORATION DE LA MER
CHARLOTTENLUND SLOT. — DANEMARK

RAPPORTS
ET
PROCÈS-VERBAUX DES RÉUNIONS

VOLUME CVII

2ÈME PARTIE
RAPPORT ADMINISTRATIF

(1937—1938)

EN COMMISSION CHEZ
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NOTICE

The annual Procès-Verbaux des Réunions will be issued in three parts under the same volume-number:

1° Report of Proceedings at the annual Council Meeting,

3° Administrative Reports for the past year, and

3° Appendices to reports and proceedings, i. e., minor reports to administrative reports and papers read at Committee meetings.

Each part will be published separately and issued as soon as possible.

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COPENHAGUE — IMPRIMERIE BIANCO LUNO A/S

REPORT

of

ADMINISTRATION 1937—1938.

(May 12th, 1938).

I. General.

Composition of the International Council for the Exploration of the Sea.

During 1937—38 a request for membership has been received from the Icelandic Government. In accordance with Article 2 of the Statutes: "New States may be admitted to the Council with the unanimous approval of the participating States. The engagements of the States which have entered during a quinquennial period are effective until the end of that period", — such approval has been asked through the Danish Foreign Office, and all Governments have given their consent to the admission of Iceland, with the exception of the Spanish Government from which no reply has so far been received. Expecting that an approval has been delayed due to the present difficulties in Spain, the Bureau have decided to receive Delegates from Icelandic at the coming Council Meeting.[1])

The number of adhering countries has thus been raised from 14 to 15. — The Portuguese Government, however, has announced the retirement of Portugal from the end of the present 5-year period, July 21st 1941.

The Council has suffered the loss of two Delegates during 1937—38: Mr. S. K. Asserson, Norway, died suddenly on July 19th, 1937, and Mr. Charles Green, Éire, passed away on February 9th, 1938. Mr. A. E. J. Went, Dublin, has been appointed second Irish Delegate, and Mr. Oscar Sund, Bergen, has been appointed in lieu of Mr. Asserson.

[1]) The consent of Spain was received immediately after the Meeting. Adm. Secr.

Composition of the Bureau.

No change as to the composition of the Bureau has taken place during the past year, and the Bureau thus consists of:— Mr. H. G. Maurice, President; Professor Johan Hjort, M. Théodore Tissier, Dr. C. Heinrici and Professor Martin Knudsen, Vice-Presidents; — Professor Otto Pettersson is Président D'Honneur with the right to attend meetings of the Bureau.

Committees.

A list of Committees will be found in the Procès-Verbaux of the last Council Meeting. These Committees remain in being and no change of membership has been announced up to date; neither have new members as yet been appointed to replace Messrs. Asserson and Green. Changes and appointments will be published as usual in the Procès-Verbal of this year's meeting.

Audit of Accounts.

The Accounts for the year 1936—37, published in last year's report, have been audited by qualified Accountants and inspected by the Finance Committee and will be submitted to the Council for final approval.

A preliminary Statement of Accounts for the year 1937—38 is given overleaf; reasons similar to those of last year: late receipt of manuscripts in connexion with an early Council Meeting have made it impossible to have audits finished prior to the Meeting but no important alteration is expected.

Income and Expenditure Account for the year ending March 31st 1938.

EXPENDITURE

		Estimates	Expenditure	
	I. Incidentals			
1	President		6,000.00	
2	Chairman of Editorial Committee	*16,000.00*	1,000.00	
3	Hydrogr. Consultant		3,000.00	
4	Editor of Statistics		2,000.00	
5	Editors of Journal		4,000.00	
				16,000.00
	II. Headquarter Staff			
6	Adm. Secretary	*12,000.00*	12,000.00	
7	Hydrographer	*3,000.00*	3,000.00	
				15,000.00
	Clerical Staff			
8	1st Asst. Secretary		6,000.00	
9	2nd — —		5,000.00	
10	Statistical —		4,800.00	
11	Secretarial Assistant	*26,000.00*	2,400.00	
12	Hydrograph. Secretary		3,000.00	
13	Clerical Assistance		4,800.00	
				26,000.00
	III. Office Expenses			
14a	Rent		5,580.00	
b	Light and Heating		1,037.34	
c	Stationery, Books, etc.		3,726.36	
d	Teleph., Telegr., Postage	*15,000.00*	1,549.07	
e	Furniture and Fittings		120.33	
f	Insurance		350.26	
g	Upkeep, Cleaning, Rep.		1,928.43	
h	Miscellaneous		1,556.13	
				15,847.92
15	**IV. Travelling Expenses**	*14,000.00*		5,648.83
16	**V. Chairmen of Committees**	*31,000.00*		31,000.00
17	**VI. Printing and Distribution**	*38,200.00*		35,093.57
	Ordinary Expenditure	*155,200.00*		144,590.32
	VII. Extraordinary Expenditure			
18	Fiches Faunistiques	*4,000.00*	2,519.61	
19	— — Honorarium	*1,000.00*	1,000.00	
20	New Furniture	*1,000.00*	947.08	
21	Prof. SANDSTRÖM's work:			
a	Council's contribution (carried forward from 1936/37)	*5,750.00*		
b	Balance of contribution of the Association Internat. d'Océanographie Physique which has been carried to the reserve	*3,569.87*	2,602.14	
22	Material for Standardisation of Photocells etc.	*2,000.00*	283.50	
				7,352.33
	VIII. Pension Fund			
23	Transferred according to Standing Resolution	*3,500.00*	3,500.00	
24	Refund of Pension	*6,500.00*	6,500.00	
				10,000.00
	Total Expenditure	*182,519.87*		161,942.65
	Excess of Income over Expenditure			8,084.26
				Kr. 170,026.91

INCOME

		Estimates	Income	
	I. Annual Contributions [1]			
	France $^{20}/_{4}$ 38 1937—38	*20,000.00*	20,000.00	
	Germany $^{12}/_{11}$ 37 —	*20,000.00*	20,000.00	
	Great Britain $^{18}/_{5}$ 38 —	*20,000.00*	20,000.00	
	Spain —	*20,000.00*		
	Denmark $^{14}/_{3}$ 38 —	*10,000.00*	10,000.00	
	Holland —	*10,000.00*		
	Norway $^{21}/_{4}$ 38 —	*10,000.00*	10,000.00	
	Poland $^{25}/_{10}$ 37 —	*10,000.00*	10,000.00	
	Sweden $^{31}/_{7}$ 37 —	*10,000.00*	10,000.00	
	Belgium $^{21}/_{2}$ 38 —	*5,000.00*	10,000.00	
	Finland —	*5,000.00*		
	Ireland $^{28}/_{4}$ 38 —	*5,000.00*	5,000.00	
	Latvia $^{23}/_{2}$ 38 —	*5,000.00*	5,000.00	
	Portugal $^{5}/_{3}$ 38 —	*5,000.00*	5,000.00	
		155,000.00		125,000.00
	II. Outstanding as per $^{18}/_{5}$ 38			35,000.00
	III. Interest on Bank Deposits	*800.00*	1,288.24	
	Interest on Investments	*6,000.00*	6,000.00	
		6,800.00		7,288.24
	IV. Sale of Publications	*2,200.00*	2,738.67	
				2,738.67
	Total Income			Kr. 170,026.91

[1]) The dates after the name of the country indicate the date of the payment received.

Statement of Pension Fund Accounts 1937—1938.

EXPENDITURE		INCOME	
Mrs. Drechsel's Pension	6,500.00	Balance as per April 1st, 1937	50,212.39
Balance as per March 31st, 1938	56.223.18	Transferred from revenue	3,500.00
		Refund of pension paid	6,500.00
		Interests	2,510.79
Kr.	62,723.18	Kr.	62,723.18

Balance Sheet, 31st March, 1938.

LIABILITIES			ASSETS		
Capital Reserve:			Cash at Handelsbanken	42,125.71	
Balance per April 1st, 1937	242,727.01		— - Ordrup-Charlottenlund Bank	5,611.88	
plus Excess of ordinary Income over ordinary Expenditure	25,436.59		— in hand	5,007.56	
	Kr. 268,163.60			Kr.	52,745.15
less Extraordinary Expenditure chargeable to Capital Reserve	17,352.33		Danish Treasury Bonds (nom. value Kr. 120,000; Market value on March, 31st, 1938 Kr. 120,000) at cost		118,543.43
		250,811.27	Pension Fund:		
Pension Fund		56,223.18	Cash at bankers	287.97	
Total Funds		307,034.45	Danish Treasury Bonds (nom. value 56,000; market value on March 31st, 1938, Kr. 55,749) at cost	55,935.21	
Sundry Creditors as per March 31st 1938		11,133.76			56,223.18
			Sundry Debtors as per March 31st, 1938		90,656.45[1]
	Kr.	318,168.21		Kr.	318,168.21

[1]) Furthermore Rbl. 14,430.54 (Russian Contr. 1914/15) deposited in a Leningrad Bank from which it has not yet been possible to withdraw it.

The statement gives rise to few remarks only; Office Expenditure is overdrawn by some 850 Kr. due mainly to stationary; Travelling shows a considerable saving due to the Faxe Bay Ctee. postponing their meeting. Printing is below estimate, partly due to the Index-Volume not being ready and partly to savings on translations. The cost of printing, however, has increased by more than 20 %, and the manuscript by Prof. Järvi being about twice the estimated length the saving is about 3000 Kr. only.

The Ordinary Expenditure thus appears some 11,000 Kr. below estimates, and similarly, the Extraordinary Expenditure totals Kr. 17,352·33 only against an estimate of Kr. 27,319·87 due to (1) the completion of Fiches Faunistiques showing a saving of some 1,500 Kr., (2) Prof. Sandström drawing ca. Kr. 2,600 out of the balance of the grant, Kr. 9,319·87, only, and (3) to less than 300 Kr. being spent out of the 2,000 Kr. grant for Standardization of Photocells. The latter two items will re-appear on the Estimates for 1938—39, while the first one is a definite saving.

Income is some 6,000 Kr. above Estimate; Belgium has paid Kr. 10,000 instead of the estimated Kr. 5,000, and Interest on bank deposits and Sale of Publications both being better than expected, the total Income permits adding Kr. 25,436·59, — excess over ordinary expenditure — to the reserve, which however is subject to deduction of extraordinary expenditure — Kr. 17,352·33; Kr. 3,500 of this re-appears on the Statement of Pension Funds, and added to an interest amounting to Kr. 2,510·79 (not appearing in the Income and Expenditure Accounts), the total Funds of the Council finally amounts to Kr. 307,034·45 as against Kr. 292,939·40 last year.

Meetings.

Meetings of the Bureau took place in July, 1937, and April, 1938, in Copenhagen and London respectively. All members of the Bureau and the Administrative Secretary were present on both occasions.

A Special Meeting of Mackerel Experts took place at Plymouth on December 8th and 9th, 1937, (Rapp. et Proc. Verb., Vol. no. 105, I, p. 24) — a report by the chairman, Dr. Stanley Kemp, is appended the Adm. Report of the Atlantic Slope Committee on page 21.

A meeting of the Sub-Ctee. on Standardization of Photo Cells (see Rapp. et Proc. Verb., Vol. no. 105, I, p. 34) took place in Copenhagen on September 27th, 1937; a report has been issued to members of this committee. — The Sub-Ctee. on Prof. Sandström's work (Rapp. et Proc. Verb., Vol. no. 100, I, p. 33) met in Copenhagen on April 9th, 1938, to study the progress made.

The Council was invited to attend the centenary of "Chalutage à Vapeur à Arcachon" on July 24th, 1937; Dr. Ed. le Danois represented the Council on this occasion and reports: "Les Armateurs français l'ont prié de transmettre leurs très vifs remerciements au Conseil International pour ce témoignage de sympathie".

The Finnish Delegates, Prof. Järvi and Mr. Granquist, attended the fiftieth anniversary of the Geographical Society of Finland at Helsingfors on January 22nd, 1938. The following communication was received after the event: "La Société de Géographie de Finlande tient à exprimer sa profonde reconnaissance pour les salutations et les vœux qu'elle a eu l'honneur de recevoir à l'occasion de son cinquantenaire."

II. Work in Copenhagen.

The ordinary routine work has been carried out on the customary lines and the usual statements as to publications, hydrographical, and statistical work follow below:

A. Publications.

Report regarding publications issued and cost of same during the financial year 1937—38.

Series	Volume	Pages	Subject	Estimated	Cost
Rapp. & Procès-Verbaux	CV (I—III)	212	Procès-Verbal, Rapport Administratif et Appendices ...	*6,000*	5,903.70
—	CI No. 4	32	Report of Special Meeting	*200*	608.34
—	CVI	114	Prof. Järvi: Fluctuations in the Baltic Stock of Salmon (1921—1935)	*2,000*	3,530.26
—			Index-Volume	*1,500*	0
Bulletins		118	Bulletin Hydrographique, 1936	*5,000*	5,340.63
—		48	Bulletin Statistique, 1935	*2,000*	1,806.26
—		68	Matthews' Tables	*2,000*	1,813.75
Journal du Cons.	Vol. XII, 1—3	392	.....	*8,000*	7,952.57
			Miscellaneous	*1,500*	342.55
			Total...	*28,200*	27,298.06
			Translations	*3,000*	834.00
			Distribution	*3,000*	3,016.85
			Registration of Hydrographical Data	*4,000*	3,944.66
			Grand Total...	*38,200*	35.093,57

The above list of Publications issued during the financial year 1937—38, proves the difficulty of estimating manuscripts not actually finished before estimation. Standard issues vary but little but individual reports like Prof. Järvi's on Fluctuations in the Baltic Stock of Salmon may easily reach twice the length originally intended.

The Index-Volume recommended last year is almost ready in manuscript; the alphabetical list of authors is in press, while the subject-catalogue, arranged in the chapters: Administration, Hydrography, Sea-bottom, Plankton, Biology and Fisheries — is ready for the inspection of the Editorial Ctee.

All papers written in a language foreign to the author are now being read and corrected by English, French or German experts before printing. This procedure is necessary although causing delay in preparing the papers for press, a fact which should be borne in mind by all authors.

B. Hydrographical Department.

The usual work of reporting meetings has been carried out by the Hydrographer and his Secretary, while the routine work with the preparation of the Bulletin Hydrographique, separate lists of observations, redrawing and duplicating thermograms etc. has been carried out by mutual assistance of hydrographic and secretarial staffs.

The work on the hydrographical card-index has been continued and now covers practically all t° and S $^{0}/_{00}$ observations published in the series collected in the Council's Library.

Samples of sea water have been received for control analyses from the Department of Lands and Fisheries, Dublin.

The installation of instruments for standardization of photo cells is well in hand and the necessary experiments are being carried out by the Hydrographer.

C. Statistical Department.

The Bulletin Statistique for the year 1935 has been published and the work on that for 1936 is well in hand but material is still outstanding from a number of countries and the issue can hardly be expected until late in 1938.

Reports of Area Committees.

NORTH-EASTERN AREA COMMITTEE

1937.

By

Oscar Sund (Vice-Chairman).

It may be noted with satisfaction that the research work in the Area was considerably greater in 1937 than in former years, as an experimental fishing and oceanographic cruise to the Barents Sea was organized by Germany while an interesting fish-marking experiment was carried out by the English laboratory in Spitsbergen waters. A short review of the various activities is given below.

A. CRUISES

Germany.

With a trawler chartered for the purpose, an extensive programme of oceanographical investigation covering nearly all the Barents Sea was undertaken in October, together with experimental trawling to ascertain the character of the fish fauna and to secure age data for the various kinds of fish. The following lines were worked:—

1) across Finmark Deep from Kjölnes,
2) from Vardö across Skolpen Bank,
3) from the edge of North Deep towards Kanin,
4) from Kanin to NW. Petchora,
5) from Kolguyev across Goose Bank,
6) from Goose Bank to Skolpen Bank.

At each station one-hour hauls with the common commercial trawl were made, together with surface plankton hauls.

In the latter part of the same month an observer made the passage to the Barents Sea in one of the Wesermünde trawlers which fished mainly in the North Deep. The object was to obtain age data for fish and hydrographic observations.

Norway.

a) The Fisheries Directorate employed its own vessel "Johan Hjort" almost continuously the whole year and, in addition, chartered three other vessels for single cruises. The following cruises were carried out:—

Area	Period	Stations	Number of Observations of				Plankton hauls	
			t° & S°/₀₀	O_2	pH	Phosph.	horiz.	vert.
W. Coast Herring area	6/1—11/3	35	319	—	—	—	—	3
Lofoten	20/1—5/4	215	2018	583	613	486	127	6
North Sea	12/4—7/5	139	1123	427	—	—	—	46
Ofoten—Lyngen	7/4—23/4	35	345	202	—	—	—	27
Finmark waters	30/4—7/6	125	1186	756	738	657	110	50
W. Coast Fjords	28/5—28/7	25	77	—	—	—	—	58
Coast of N. Norway	24/7—18/9	69	730	—	—	—	18	106
Norw. Sea and W. Coast	27/9—6/10	35	350	240	—	—	20	47
W. Coast Herring area	11/12—17/12	29	320	306	—	—	—	—
Möre Bank	27/6—12/7	Current measurements etc. (two vessels).						

b) The Geophysical Institute, Bergen. The Institute's vessel, the "Armauer Hansen", undertook every month short oceanographical voyages to a number of fjords in the vicinity of Bergen, and made special voyages to the Sognefjord, the Nordfjord and the Hardanger Fjord in the summer. In each of the months of June and July oceanographical sections were run in the Norwegian Sea. A programme of current measurements and observations on internal waves was carried out on the Möre bank from June 27th to July 12th in co-operation with two vessels chartered by the Fisheries Directorate.

c) The Tromsö Museum received grants from the Fishery Research Fund for investigations in the neighbourhood of Tromsö at all seasons and on the Finmark coast in early spring. In all, 110 oceanographic stations were worked and the following number of observations made:—

t°	S‰	O_2	pH	Phosphate
998	994	994	811	820

B. FISH MARKING

England.

Two members of the staff of the Lowestoft Laboratory sailed in a trawler to Spitsbergen with the object of marking trawl-caught cod and succeeded in marking and liberating 474 fish. Although the fish were obtained from very deep water, 500—1000 fathoms, they were very lively and it is supposed that the great majority survived. The marking was done west of Hornsund and one fish was recaptured afterwards as far as 60 miles NW. of Bear Island.

Norway.

a) **Cod.** During the winter, from mid-December until the beginning of March a fish marker worked on long-line cutters fishing on the grounds west of the islands Senja and Kvalöy (Lat. 69° N.) and marked 874 large cod in a ripening condition. Later, in March, the same man went to Væröy and marked 505 cod about to spawn. These experiments have been reported on by Sund.

b) **Halibut.** In the course of the investigations on halibut biology, rendered necessary by the sudden growth of the use of gill nets in the autumn of 1936, about one hundred halibut were marked in certain northern Norwegian fjords in January and February, and in May a like number of smaller fish were marked on the Röst Banks (Lat. 67° N.). In July, a number of line-caught fish were marked on the Faroe Banks.

C. BIOLOGICAL STATISTICS

Germany.

Nearly thirty thousand **cod** and as many **haddock** from the three divisions of the Area (Barents Sea, Bear Island Bank, and Norwegian Coast) were measured at the German fishing ports. Data for age determination were collected on the cruises mentioned above. About 12,000 age determinations have been made. Stomach contents were also noted and preserved material is under examination.

Norway.

Cod measurements were carried out on the same scale as in previous years, 5 measuring parties being at work in the fishing districts from early February until the middle of June. 5,000 otoliths were collected and a great number of vertebral counts made.

Herring. 45 samples of winter herring, comprising altogether nearly 8,000 fish, were collected. Three scales from each fish were mounted on microscope slides, and length, weight, sexual maturity and vertebral number were ascertained. 9 samples of fat herring (1,700 fish) were collected, and in 6 of these samples vertebral counts were made. Otherwise the fish were examined in the same way as the winter herring samples. 10 samples of small herring ("mussa") were received. 100 fish from each sample were examined for age and number of vertebrae. Only two samples of North Sea herring were secured, which were dealt with in the same way as the winter herring.

Sprat. Samples of sprat were received continuously and examined for age and vertebral number, which was found to be generally lower in 1937 than usual.

Plaice has been regularly studied in recent years. In 1937 the spent "parent" fish from the hatchery in Trondheim were used for age determination and vertebral count. Many data on small plaice were obtained during the summer cruise of the "Johan Hjort".

Halibut. The study of the halibut stock became imperative in the autumn of 1936 when a new method of fishing for halibut was introduced, namely, gill nets in deep water, especially on the flat clay floors of the fjord deeps. A considerable number of measurements have been made, and otoliths and other material have been collected. A preliminary report is being published by Devold.

Haddock. A few thousand haddock were measured in Finmark during the spring fishery.

D. OTHER BIOLOGICAL WORK

In order to enable the effect of liberating newly hatched **plaice fry** to be estimated, work has been in progress for a few years on the production of a new kind of flatfish, of which the spread and survival of naturally produced fry could be easily followed. A cross between plaice and flounder proved a suitable subject for such experiments, since this bastard form, when reared to the bottom stage, was found to survive in a much higher proportion than the "pure" plaice. Accordingly large numbers of these mongrel "plaice-flounders" have been liberated in sheltered areas in which plaice fry have also been released. Last spring (1937) 7 million "mongrels" were set free in the nearly landlocked Borgen Fjord, a branch of the

inner Trondheim Fjord, and 2 millions in the small fjord Lyapollen on the island of Hittra, together with 4 million plaice fry. The effect of both these operations has, however, been inappreciable.

E. HYDROGRAPHY

The hydrographical work at sea is described above under "Cruises". Among the other activities of the oceanographical department of the Fisheries Directorate may be mentioned the thermograph work on liners running along the coast from Oslo to Bergen (to and from every week) and from Bergen to East Finmark (fortnightly). In addition, hydrographic observations are made every fortnight at the standard depths at the following positions:—

1) Sognesjöen, mouth of the Sognefjord.....	Lat. 62° N.,	depth	320 m.
2) at Skraava, E. side of Lofoten	— 68° N.,	—	310 m.
3) at Eggum, W. side of Lofoten	— 68° N.,	—	230 m.
4) at Ingöy, NW.Finmark	— 71° N.,	—	280 m.

A review by Eggvin of the data so far obtained from this routine work at fixed stations and from the thermograph records will appear shortly.

The joint work of the Geophysical Institute, Bergen, and the Fisheries Directorate in collecting data for the study of internal waves in the sea, carried out in June—July, has been described above under "Cruises".

F. PUBLICATIONS

German.

Lundbeck, J., Die Deutsche Fischerei in den nordosteuropäischen Gewässern in der Fangzeit 1936—37. (Deutsche Fischerei-Rundschau 1937, H. 3).

Kersting, W., Die Forschungsfahrt mit dem F. D. "J. H. Wilhelms" in das Barentsmeer im Oktober 1937. (Ibidem, H. 24).

Norwegian.

Eggvin, J., Trekk fra Nordnorges Oceanografi sett i sammenheng med torskefisket. (Aarsber. vedk. Norges Fiskerier 1937, 2).

Rollefsen, G., Aldersundersökelser. (Ibidem).

Sund, O., Merking av Torsk. (Ibidem).

— Torskebestanden i 1937. (Ibidem).

Johan Hjort og Johan T. Ruud, Rekefisket som naturhistorie og samfundssak. Fiskeridirektoratets Skrifter, Ser. Havundersøkelser. (Rep. Norw. Fish. Mar. Invest.) Vol. V, No. 4, Bergen, 1938.

Sven Runnstrøm, A Study on the Life History and Migrations of the Norwegian Spring-Herring based on the Analysis of the Winter Rings and Summer Zones of the Scale. (Ibid., Vol. V, No. 2, Bergen, 1936).

Erling Sivertsen, Torskens gytning. Undersøkelser 1934—35. (Ibid., Vol. V, No. 3, Bergen, 1937).

Sven Runnstrøm, Sildeundersøkelsene 1936. (Årsber. vedk. Norges Fiskerier 1936, No. V, Bergen, 1937).

NORTH-WESTERN AREA COMMITTEE

1937.

By

Å. Vedel Tåning.

The decrease in the **cod** fishery in the Icelandic area which began in 1935 and was very rapid in 1936 has continued; we know now that the decrease in yield has its immediate cause in a series of bad brood years following some very prolific brood years, of which 1922 is the richest up to the present on record in the area. According to recent investigations, there is now, however, some prospect of a few good younger year-classes in Iceland and Greenland waters, which should raise the yield in the coming year.

The yield per unit of gear of the other important demersal fish, viz., **plaice, haddock,** and **halibut**, shows a steady decrease in the Iceland—Faroe area, and this is evidently brought about, not primarily by fluctuations of the brood strengths, but by the growing intensity of the fishery for these species. The **herring** has appeared in enormous quantities in the Iceland area; it is also much more common in Greenland waters in recent years than formerly. The migration of this fish and the fluctuations in brood strengths are, however, very imperfectly known in the area and there is still much work to be done on this very important species in the future.

As hitherto, the work of the Committee during the preceding year has been directed mainly to the collection of data on the stock of the five important species referred to above, and studies are in progress on fluctuations within the stocks and on the migrations performed by the fish at various stages; routine collection of hydrographical and plankton data has been continued.

It is undoubtedly necessary to maintain this routine work as the chief interest so long as the material from research vessels is only available in restricted quantities for the huge area, though other important studies must not be entirely overlooked. This year it must again be emphasized that many investigations of the greatest importance have had to be postponed; this is the more to be regretted since the various nations are giving increasing attention to the fisheries of the far north.

Denmark had no research vessel in the area last year, as the building of the new "Dana" was unexpectedly delayed; various other vessels (mentioned below) worked in the Committee's area, however, and work of various kinds was done from commercial vessels.

From Denmark the M/B "Umarissok" and the Royal Naval patrol vessel "Heimdal" worked in Greenland waters, the Royal Naval patrol vessel "Hvidbjørnen" in Iceland waters, and the M/B "Amy" in Faroese waters; the Icelandic patrol vessel "Þor" worked in various months; France made observations with the despatch-vessel "Ville d'Ys"; Holland sent the "Nautilus" on a cruise to Iceland, Scotland the research vessel "Explorer" to the Faroe area, and Sweden the research vessel "Skagerak" also to the Faroese waters.

Hydrographical and plankton observations made in the area will be reported by the respective Committees, and the hydrographical data will be published in due course in the *Bulletin Hydrographique*.

Denmark.

A cruise with the new research vessel to the Faroes, Iceland, and Denmark Strait was planned for the year 1937. Unforeseen difficulties arose, however, and towards the end of May the cruise had to be abandoned for the year. As it was rather late in the season, it proved impossible to make other arrangements and Denmark has consequently been unable to contribute her share to the routine investigations in the area this year.

Faroes.

During the month of April 411 large spawning **cod** (all > 70cm.) were marked on the spawning grounds in the waters north of the islands ("Nordhavet"); the two main problems to be studied were the number of recaptures during the first season, and

the migrations undertaken after spawning. A total of 54 fish or 13·1% were recaptured during 1937; this is the percentage of spawning cod ordinarily taken in recent years during the marking year, though a little lower than when the cod are marked earlier in the season (ca. 16%), a little higher than when the marking has been done later in the season (ca. 12%). As regards migrations the experiment clearly shows the dispersion after spawning over the banks round the Faroes; a single recapture was returned from a distant locality, Bear Island, the fish in question having been marked on 5th April and recaptured on 21st November by a Hull trawler. We have not previously had back more than a few fish which had left the area, and none had undertaken such a long migration. This, however, is not surprising in view of the information obtained during the Greenland—Iceland marking investigations.

The following table summarizes the marking carried out in recent years in Faroe waters.

Year	Month	Number marked		Size % > 70 cm.	Number of Recaptures 1. Year[2])	2.	3.	4.	Total Rec. in %
1932.....	IV—V	226	Spawning cod	100	27	16	2	0	20
1935.....	III—IV	244	— -	95	40	4	3	—	19
1936.....	III and VI	304[1])	Codling	4	74	8	—	—	27
1937.....	IV	411	Spawning cod	100	54	—	—	—	13

[1]) marked by courtesy of Dr. R. S. Clark from H.M.S. "Explorer".
[2]) = marking year.

Data have been collected from commercial catches for the study of fluctuations in the stock of cod along the lines followed for some years. A total of 15,950 measurements and 1,480 samples of otoliths have been collected from four areas (see Fig. 1). The 1933 year-class appeared in 1937 on the spawning grounds; replacing the 1930 year-class; the next good year-class is the 1936 brood. Of recent years the outstanding broods have been those of 1927, 1930, 1933 and 1936, whence there appears to be a 3-yearly period of occurrence at present.

During the summer (beginning in June) experiments with herring drift-nets were carried out on the offshore banks and in deeper water. As in the previous year the experiments were made mainly east and north-east of the Faroes; the catches were, however, always small, though a few samples were procured for racial investigations. These together with other samples of herring from the Faroe fjords have been examined by Dr. H. Wood, Marine Laboratory, Aberdeen. A preliminary report on them has been made, and when more data have been received Dr. Wood will publish the results. Up to date about 1300 herring from the Faroes have been examined by Dr. Wood; of these only some 250 specimens were taken on the offshore banks, the rest having come from the fjords. A sample caught SSE. of Suderø, 28th July 1936, consisted of herring which, according to the development of the gonads and the counts of vertebrae and K_2, were autumn spawners. The remaining samples seem to have consisted mainly of spring spawning herring.

Herring which were examined from the offshore waters east and north-east of the islands in 1937 were predominantly spring spawners, though it is possible that a few autumn spawners may have been present. There is obviously a very close resemblance in size and racial characters between the herring caught on the continental shelf at Shetland in February and March, and the herring caught in the neighbourhood of the Faroes during the summer of 1937. The available data lead one to believe that in the deep northern seas extending from the west coast of Norway, north of Shetland to Faroe, there is a population of large adult herring, the big majority spring spawners, which are closely allied racially to each other but which may split up into different spawning communities.

During July—August a Skagen motor-cutter "Amy" was chartered for research work in the Faroese fjords

Fig. 1. Areas where collection of Cod Material is carried out every year, Faroes.

and on the banks close to the islands; the object of the fishing experiments was a study of the distribution of the **Norway lobster** (*Nephrops*[1]) and **prawns** (*Pandalus borealis*) in the area. Lobster and shrimp trawls were used. The prawn, however, was not found either in the fjords or on the banks. The Norway lobster was present in the deeper basins of the sheltered fjords in depths from about 20 to 75 metres where we have the deeper clay bottom community (*Axinus flexuosus* community) described from these waters by R. Spärck (Scientific Report of the North-Western Area Committee for 1926—27, Rapp. et Proc.-Verb., Vol. LVII, p. 7). The sketch-map shows the distribution of the species as shown by the investigations; the species is not met with in the fjords of Suderø nor on the nearer banks round the

Fig. 2. Distribution of Norway Lobster (*Nephrops*) in Faroese Fjords. Black: common; + rare. The species was not recorded from the southern island, Suderø.

islands. The stock has never been exploited by local fishermen and was found to be a typical accumulated stock, very large in various small localities, in some of which it was possible to catch 70—115 kg. of sizes greater than 16 cm. in hauls of one hour. The specimens ranged from about 7 to 26 cm. in length (as measured from the tip of the spine to the end of the telson); and several thousand were measured; very few females over 16 cm. were found. About 4000 lobsters from the richest grounds were marked; and of them 2% were recaptured in 12 hours' fishing carried out 1—3 weeks later by the cutter "Amy"; this is a high percentage of recaptures for a single vessel in a few hours' work in the area. The stock is evidently fairly closely restricted to small areas and could probably be easily overfished.

A number of other investigations was undertaken. During the fishing experiments fairly large quantities of **flatfish,** haddock, etc. were caught. The witch (*Pleuronectes cynoglossus*) was moderately abundant in the fjords in which the deeper clay community occurred; fish of 30—49 cm. were most common. Halibut of the age-groups I—IV were common in the fjords and 70 specimens ranging from 40—70 cm. were marked; the few recaptures so far made show an emigration from the fjords to the offshore banks.

During the year 174 **whales** were caught at the Faroes; the Lopra Whaling Station (with 3 whale catchers) and the Thorsvig Station (with 2) having taken 141 fin whales, 11 sei whales, 7 blue whales, 4 humpbacks and 11 sperm whales.

A relatively large number of the ca'ing whale (blackfish) was captured by the natives in the fjords during the year.

Iceland.

During the year, as mentioned above, no cruise was undertaken by Denmark to this area. Supplementing the material collected by Mr. Á. Friðriksson from the "Þor" and by Dr. J. J. Tesch from the "Nautilus" some data on **plaice** have been procured, part from the Faxa Bay area, and part from Adalvik.

Cod. Marking has been continued along the lines followed for some years. Early in the spring (8th—20th March) about 1,000 spawning cod were marked and liberated off Westmanna Islands from the patrol vessel "Þor". The number of recaptures during the year was 56 fish, i. e., 5·7%; as has already been shown from previous experiments in the area (Táning: Journ. du Conseil, XII, 1937 p. 31), the percentage recapture expected in the first year is approximately 5%; in other areas, as, for example, the Faroes and Norway, the percentage recapture in the first year is much higher. None of the specimens marked in 1937 and earlier has appeared during the year in West Greenland or other distant waters, and, further, the emigration from West Greenland to Iceland has been very low, actually only 5 fish originating from West Greenland and one from East Greenland having been caught on the Icelandic banks during 1937; this is indeed very low as compared with the period 1931—35, when there were 35—57 recaptures of Greenland marked fish in Icelandic waters in the year.

An unusually long migration, from West Greenland to Iceland, was recorded during the year, a cod having travelled from Disco Bay (Egedesminde) to Faxa Bay, off Akranes, in Iceland.

Several cod marked in previous years, and also plaice and sea wolf (*Anarhichas lupus*), have been recovered in the Icelandic area during the year.

In connexion with the proposed closure of Faxa Bay material collected from this region in the course of the researches undertaken there since 1924 has been made use of in various preliminary reports.

[1]) The common lobster (*Homarus*) is not found at the Faroes, the species being unable to propagate owing to the low temperatures.

The Danish and Icelandic fishery patrol vessels have continued the collection of data on the fixed hydrographical sections, and the "Nautilus" has also contributed observations made during her cruise in the area.

"Fiskifélag Islands" continued its activities as in previous years until 15th September, when the Department of Fisheries of the University Research Institute undertook the marine investigations. These will be carried on henceforth under the direction of Mr. Árni Friðriksson, who has given the following particulars of the investigations in 1937.

The patrol boat "Þor" was engaged in fishery research work between 23rd May and 15th July, and from 23rd to 28th October. The principal object of the first cruise was the study of the relation between the hydrographic conditions on the deep sea banks where the fishery for Norway haddock (*Sebastes*) takes place, and the relative numbers of this fish on the banks. The first few days of this and the second cruise were spent in trawling operations in Faxa Bay, for the purpose of obtaining a general view of the relative numbers of food fishes on the different grounds in the bay.

The following research work was carried out during the year:—

Cod. About 24,380 cod from the commercial fishery and from the "Þor"'s cruises were measured and about 5,880 age analyses were carried out. On the banks off the south and south-west coasts, where the great cod fishery takes place between January and May, no new year-classes were found, the fishery depending only on old year-classes, particularly those of 1922, 1924, and 1926. The yield of the fishery was therefore very bad. In the cold water area, off the north-west, north and east coasts, on the other hand, considerable quantities of young immature fish were found. Here the predominant year-classes were the broods of 1930, 1931 and 1932.

Herring. 468 herrings trawled in winter were measured, and examined for sex and maturity. 10,469 herring from the north coast fishery, 2137 autumn herring from Faxa Bay, and 1288 fish mostly small herring, from the west and east coasts were measured. Many of these herrings were examined in regard to maturity, weight, intestinal fat, etc., and a large number of scales collected for age determinations at a later date. Finally, over 1200 fish have been examined for differences in racial character. Quantitative stomach analyses were carried out, particularly on the herring caught off the north coast, 355 stomachs being examined.

Norway Haddock (*Sebastes*). During the "Þor"'s cruises, besides other fish, 10,928 specimens of Norway haddock were examined, and several hundred otoliths were collected for later study.

Other Investigations. 465 specimens of Greenland halibut (*Platysomatichthys*) were examined for length, weight, sex, etc. In addition, 29,837 specimens of other fish of various species (flatfish etc.) were measured, and many examined in other ways.

The investigations on *Pandalus borealis* and *Nephrops norvegicus* have been continued, about 4,000 of the former and 950 of the latter having been examined.

Finally, numerous plankton stations (ca. 509) have been worked, some with $^1/_2$m. stramin nets, some with Hardy's Plankton Indicator, and some by the method devised by Prof. Hentschel, Hamburg. Surface temperatures have been obtained in ca. 600 localities, all round the coast and in the fjords, and deep-water temperatures have been recorded at different depths at 131 positions.

Denmark Strait.

The abandonment of the cruise with the new research vessel late in the season made it impossible to procure samples of cod larvae in 1937 from the Denmark Strait region, where they are ordinarily to be met with in July.

Greenland.

West Greenland: 1) Coastal waters: The Fishery Adviser to the "Grønlands Styrelse", Professor Ad. S. Jensen, has furnished the following particulars of the work done in the coastal waters of West Greenland during 1937.

Fishery investigations were carried out from May to October 1937 by Magister Paul M. Hansen. The M/B "Umarissok", belonging to the "Grønlands Styrelse", operated in coastal waters between Holsteinsborg (at ca. 67° N. Lat.) and the southern part of the Julianehaab district (at ca. 60° N. Lat.).

Cod. The distribution of pelagic cod larvae in the area was surveyed by means of the 1-metre stramin net, and the eel hand-seine was used in suitable localities to take the youngest age-groups of cod. Samples of otoliths of the older age-groups of cod have been collected, in part from the "Umarissok" and also from commercial catches landed at the various fishing ports in West Greenland. A total of about 3000 samples was collected throughout the fishing season and analysed, all the cod being measured and sexed, and many weighed.

Cod have been marked in the Sukkertoppen, Godthaab, Frederikshaab, and Julianehaab districts, a total of 1048 fish having been liberated.

Halibut. Otoliths were collected from commercial catches landed at the fisheries station of Kângâmiut, north of Sukkertoppen; in all, 400 samples were collected and analysed, all fish being measured and weighed.

A number of Greenland halibut, mainly of the III-group, taken from shrimp trawl catches in Amerdlokfjord, near Holsteinsborg, were measured.

Fishing experiments with long-lines have been carried out in Arsukfjord (in the Frederikshaab district), in Lichtenaufjord, and at Narssak (in the Julianehaab district); the main object of these experiments was to investigate the quantitative distribution of the Greenland halibut, and 276 fish were marked and liberated in the localities referred to.

As regards the **char** (*Salmo alpinus* L.), 800 fish were measured in the Godthaab, Frederikshaab, and Julianehaab districts and 150 samples of otoliths collected.

About 2,200 **herring** were measured in the Frederikshaab district and ca. 4000 in the Julianehaab district. Samples of scales and otoliths were taken in suitable numbers from the various catches. A few samples of herring have been preserved in formalin for racial investigations. Several samples of herring scales and samples of young herring preserved in formalin have been obtained from the fishery officer in Sukkertoppen.

The **uvak** (*Gadus ogac*) has been caught in greater numbers than for several years past in the southern districts, Frederikshaab and Julianehaab. Every specimen caught by the "Umarissok" was measured and weighed, and 300 samples were analysed for age. The vertebrae and the rays in the second dorsal fin in 200 fish were counted, to provide data for racial study in this species.

Many **capelin** (*Mallotus*) caught in various localities in the Sukkertoppen and Frederikshaab districts were measured, and the age determined from several samples of otoliths.

In all the principal localities in which the "Umarissok" worked the water temperature from the surface to 300 metres was observed.

2) Offshore Waters: On the offshore banks 300 **cod** were marked from a Faroe motor cutter, and the collection of cod measurements was also continued on the banks during the year, 2,000 measurements and 300 otolith samples being procured. The Faroese fishermen working on the banks stated that late in the season, cod which were not of the same sort as those arriving from Iceland during July—August occasionally appeared on the banks; these they termed "American Cod". Two small samples of these cod were procured and vertebral counts made (*vide* Racial Investigations below); none of the counts indicates, however, any admixture of high Newfoundland or Labrador values, the distribution of the values resembling those of other samples from the West Greenland banks.

A valuable collection of measurements of **halibut** was obtained from a motor vessel engaged in the halibut fishery on the offshore banks. 1,968 halibut were measured in centimetres, the catch weighed and the number of cod and other species counted. The halibut measurements show that in the months July—September the size of halibut on the West Greenland banks increases from south to north, the larger and older halibut being most abundant on the far northern banks.

In West Greenland waters only 17 **whales** were caught during the summer of 1937 by the Danish whale catcher "Sonja" (9 fin whales, 4 blue whales and 4 humpbacks).

Racial Investigations.

Several samples of **cod** (*Gadus callarias*) from the area have been collected during recent years and counts of vertebrae and D_2 made. Some of the data were dealt with before the death of Professor Johs. Schmidt, and the averages of all counts from the area not hitherto published are given below. Some figures from other areas are also available and will be published in detail later on.

These data supplement at various points the great material published by Schmidt in 1930 (The Atlantic Cod (*Gadus callarias* L.) and local races of the same).

Locality	Date and Year	Average Number of Vertebrae		Average Number of rays in D_2	
West Greenland					
Sukkertoppen	Summer 1927	a_{173}	53·86	a_{176}	20·81
Julianehaab	Summer 1930	a_{217}	53·11	a_{217}	20·27
Hellefiskbank	$^{11}/_{9}$ 1930	a_{159}	53·30	a_{157}	20·14
Maligiak, Ikertokfjord	$^{21\text{-}24}/_{7}$ 1931	a_{122}	54·01	a_{122}	20·41
Godhavn, Disko	$^{30}/_{7}$ 1932	a_{18}	54·17	a_{18}	20·72
Little Hellefiskbank	$^{16}/_{8}$ 1932	a_{132}	53·67	a_{132}	20·20
Godhavn	$^{15}/_{7}$ 1935	a_{152}	53·67	a_{150}	20·81
Rodebay	$^{16}/_{8}$ 1935	a_{147}	53·93	a_{130}	20·91
Offshore Banks	Summer 1937	a_{98}	53·54	a_{95}	20·49
Offshore Banks	Summer 1937	a_{75}	53·36	a_{73}	20·52
East Greenland					
Angmagssalik	Summer 1930	a_{147}	52·93	a_{146}	20·08
Denmark Strait	Summer 1931	a_{104}	53·36	a_{101}	20·03
Iceland					
Selvogsbanki (spawning cod)	Spring 1934	a_{195}	53·15	a_{171}	19·86
Jan Mayen	Summer 1931	a_{100}	53·32	a_{98}	19·96
Faroes					
West of Suderø	$^{7}/_{8}$ 1931	a_{150}	52·07	a_{149}	19·58
West of Suderø	$^{17}/_{6}$ 1932	a_{150}	52·13	a_{148}	19·55

England. (F. M. Davis).

In April 1937 a member of the staff of the Fisheries Laboratory, Lowestoft, sailed on a steam trawler, primarily to carry out vitality experiments on halibut, in and near Bredebay, Iceland.

51 halibut of 40cm. or less were marked and only one was recaptured — in the haul immediately following its marking.

It was obvious from mere inspection that the vitality of halibut is far inferior to that of plaice. Under commercial conditions the great majority of small halibut are dead or dying after a quarter of an hour on deck. Occasionally when very few fish are taken, a few may survive longer than usual.

Other observations were made.

France. (Ed. le Danois).

During May and July the despatch-vessel "Ville d'Ys" occupied several hydrographical stations in the Area (see Bull. Hydrographique for 1937); no special biological studies and fishing experiments were made.

Germany. (A. Hagmeier).

The "Hydrobiologische Abteilung des Zoologischen Staatsinstituts" in Hamburg (Prof. E. Hentschel) did not undertake any new investigations in Icelandic waters in 1937, but the following three publications relating to the area have been published:—

E. Hentschel: Über den Ursprung der Heringsnahrung im Norden von Island (Ber. D. Wiss. Komm. Meeresforschung Bd. 8).

F. Gudmundsson: Das Oberflächennetzplankton der isländischen Küstengewässer nach den Ergebnissen einer Rundfahrt (*ibidem*).

A. Meschkat: Untersuchungen über das Herbstplankton im Bereich des Ostislandstromes (Int. Rev. Hydrobiol.).

The "Arbeitsstelle für Fischereiforschung der Staatlichen Biologischen Anstalt auf Helgoland und des Instituts für Seefischerei in Wesermünde" (Dr. J. Lundbeck) has continued the studies of the statistics of market landings from fishing vessels working in Iceland and has collected data relating to measurements, scales, and otoliths of the four principal species of fish, namely, cod, haddock, saithe, and Norway haddock (*Sebastes*), to be used for routine studies of the stocks; a report will be prepared later on.

The following market measurements have been made:—

	Samples	Numbers	Weight in kg.
Cod	42	9305	39641
Haddock	20	6133	12045
Saithe	13	2721	11640
Norway Haddock	13	1621	2150
Other species	13	1102	1149
Total...	101	20882	66625

Scales and otoliths of the species mentioned below have been collected for age determination:—

	Samples	Otoliths	Scales
Cod	20	1380	—
	2	—	200
Haddock	5	300	—
	4	—	480
Norway Haddock	5	300	—
Total...	36	2,660	

Holland. (J. J. Tesch).

A voyage to Iceland was undertaken in May—June by H.M.S. "Nautilus", on which trawling was carried on and hydrographical observations collected (see Bull. Hydrographique). Several of the regular trawl stations were worked between 17th May and 3rd June

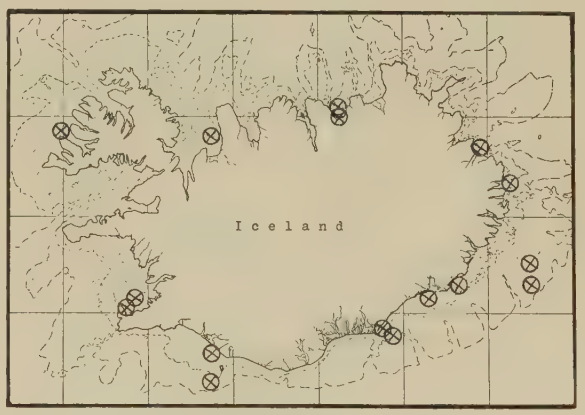

Fig. 3. "Nautilus". Trawling Stations carried out round Iceland, 17th May to 3rd June 1937.

(see the sketch-map above). The hauls (of 1—2 hours duration) were made with an ordinary commercial otter trawl (V.D. patent not used), and measurements of the important food fishes were collected and handed over to the "Marinbiologisk Laboratorium" in Copenhagen, together with otolith samples of plaice. Samples of haddock scales were sent to the Marine Laboratory, Aberdeen.

Norway. (O. Sund).

The surface thermograph records between Bergen and Reykjavik (S/S "Lyra" and "Nova") were continued as in previous years by the Fisheries Directorate.

Scotland. (R. S. Clark).

Work at Sea.

The research vessel "Explorer" operated in the Faroe—Shetland Channel, at the Faroes, and on Faroe Bank during the second half of May. Twenty-seven stations were occupied as in previous years between Flugga and Nolsø, from Faroe Bank to the Butt of Lewis and encircling the Faroes. The main objects of the cruise were:—

1. Analyses by trawl of the fish stocks round the Faroes, on Faroe Bank, and within the plateau to the north of Scotland and west of the Shetlands.
2. Hydrographic and planktonic surveys in the different areas.
3. Cod marking on Faroe Bank.
4. Search for herring larvae, north-west from the Butt of Lewis, in the region of Faroe Bank and round the Faroes.

Hydrography.

The temperature and salinity data will appear in the *Bulletin Hydrographique*. The conditions prevailing in the area were characteristic of those which were observed in 1935, namely, a more southerly distribution of the Norwegian Sea cyclonic circulation restricting the northward flow of Atlantic water.

Surface drift-bottles were liberated at each station according to the general scheme adopted by Scotland for the determination of the movements of the water masses in Scottish and adjacent areas.

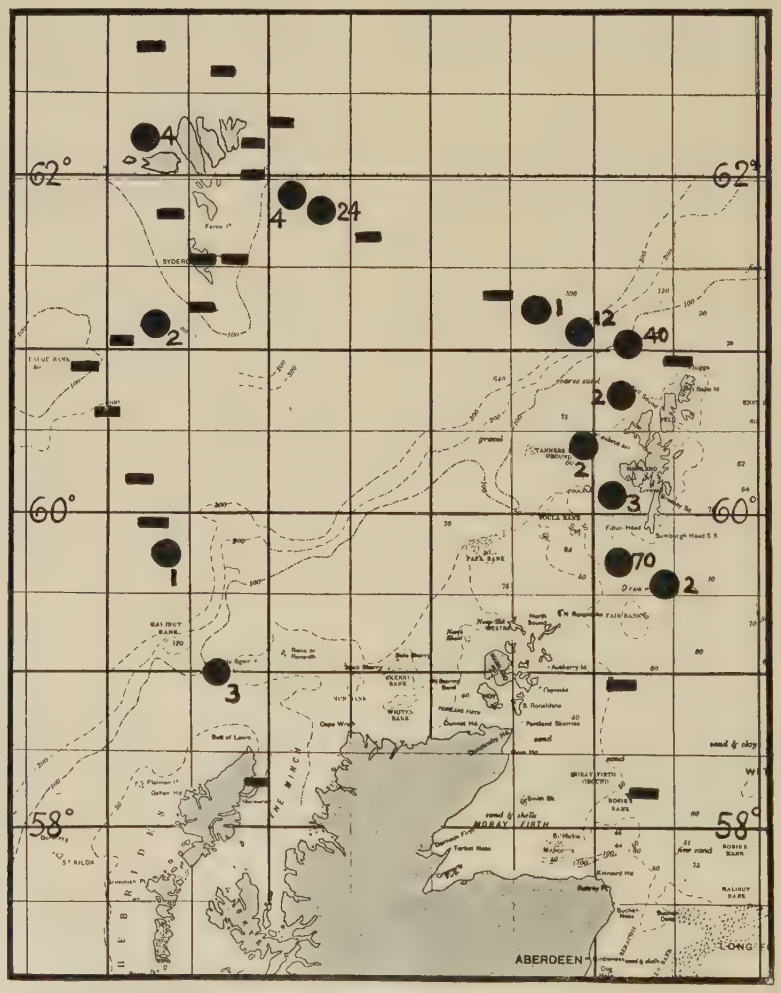

Fig. 4. Distribution of Herring Larvae within the area sampled. R/S "Explorer", May 1937.

▬ Absent ● Present

Plankton.

The usual mixture of Atlantic and Arctic forms was observed during both traverses of the deep water channel from Shetland to Faroe and Faroe Bank to the Butt of Lewis. Siphonophores (*Physophora*), *Calanus* (*finmarchicus* and *hyperboreus*), *Euchirella*, *Eucalanus*, *Rhincalanus*, *Sagitta maxima* and *Pleuromamma robusta* occurred in combination. Variations in the mixing of these forms occur from year to year and it is significant that the actual conditions observed during May 1937 approximated very closely to those encountered in June 1935. *Calanus finmarchicus* occurred in moderate numbers north-west of the Shetlands, but became more abundant towards the Faroes. On the southern section between Faroe Bank, Wyville Thomson Ridge and Butt of Lewis it was much less abundant and was largely replaced by a variety of other copepods. Herring larvae were again taken in relatively small numbers, the greatest concentration being observed east of the Faroes in the region of Sandø and Nolsø Banks. A few larvae were taken immediately south-west of the Wyville Thomson Ridge. The occurrence of a few larvae in this region in certain years is explained by a northward drift from hatching localities west of the Hebrides. Herring larvae occurred at the stations on the plateau immediately west of the Shetlands, while a few, decreasing in numbers in a westerly direction, were found over deeper water north-west of Flugga, just north of the 61st parallel, as far as longitude 3° W. These undoubtedly had their origin on the west Shetland plateau. Herring larvae, therefore, were obtained on this comprehensive cruise at two widely separated regions on the eastern side of the Faroe—Shetland Channel, as well as in the immediate neighbourhood of the Faroes, each group of larvae being quite distinct as to the region of origin.

The table (p. 18—19) gives the distribution and frequencies of occurrence of the larvae captured during the cruise.

Echo Sounding.

The echo-sounder was again used south-west from Suderø in the position 61°01′ N. 7°24′ W. to confirm previous findings of a deep channel between Faroe Bank and Suderø. A depth of 426 fathoms was registered, while the sounding lead gave 436 fathoms, the difference being due largely to the drift of the vessel. This is now the fifth consecutive year in which soundings greater than 400 fathoms have been obtained in this region.

Trawling.

The Faroe hauls were very disappointing, fish of all kinds being scarce. Off Svinø, Fuglø, Enniberg and Myggenæs, grounds which are usually well stocked with fish, the catches were almost negligible. Hauls taken east of Nolsø, east of Suderø and at the Monk Rock, however, were more productive. In the **haddock** catches, the 1935 brood predominated, as in the North Sea, while the younger year-class 1936 was poorly represented. Fairly good catches of **lemon soles** (medium and large categories) were secured off Nolsø and Suderø. A few small halibut, ranging in size from 25 to 51 cm., with the majority between 27 and 38 cm., were taken round the Faroes. A catch of twenty halibut (25 to 45 cm.) was taken in a single haul off Nolsø. Trawling operations were not successful on the two positions tried on Faroe Bank and no cod were secured for marking purposes.

Sweden. (K. A. Andersson).

A cruise was carried out with the "Skagerak" to the Faroes between late July and early August. The principal object of the cruise was to decide whether the **mackerel** occurred in such quantities on the banks north and east of the Faroes that a commercial fishery by Swedish vessels would be practicable. The investigations, which were carried out mainly by means of the "Dörg", were entirely negative. Information obtained from Faroese fishermen and our Danish colleagues confirmed our view as to the sporadic occurrence of mackerel in these waters.

In connexion with the mackerel investigations several **plankton stations** were made between Shetland and the Faroes, viz., 8 surface stations and three complete stations in depths of 236, 496 and 503 metres. Measurements of submarine light were made at one of these stations (236 metres depth), and also in two fjords, Skaalefjord and Fuglefjord.

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E. Steemann Nielsen: Undersøgelser over Stofproduktionen i Havet ved Island. Publ. om Øst Grønland No. 5, 1937.

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"Explorer". Faroe—Shetland Cruise. May 1937.

Plankton Hauls.

Date	Area	Position	Net	Depth m.	No. and sizes of Herring Larvae mm. 13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Total
18 May	C15d	58°14′ N. 1°27′ W.	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100																		
18 —	C16a	58°56′ N. 1°42′ W.	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100																		
18 —	C18d	59°34′ N. 1°05′ W.	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100													2					2
19 —	C18c	59°41′ N. 1°49′ W.	1 mcc.	0								2	3	11	13	11	8	8	1	3		60
—	—	—	—	50							1	1	1			1						4
—	—	—	—	100							1	1		1	1		2					6
19 —	C19c	60°07′ N. 1°45′ W.	1 mcc.	0																		
—	—	—	—	42										2		1						3
—	—	—	—	84																		
20 —	B19b	60°27′ N. 2°06′ W.	2 mcc.	Vert.105									1									1
—	—	—	1 mcc.	0																		
—	—	—	—	50													1					1
—	—	—	—	100																		
21 —	C20c	60°43′ N. 1°39′ W.	2 mcc.	Vert.110																		
—	—	—	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100						1				1								2
21 —	D20a	60°56′ N. 1°00′ W.	2 mcc.	Vert.115																		
21 —	C21c	61°01′ N. 1°36′ W.	2 mcc.	Vert.170							2	7	9	13	4	1	1	2				39
—	—	—	1 mcc.	0																		
—	—	—	—	50									1									1
—	—	—	—	100																		
21 —	B21d	61°08′ N. 2°10′ W.	2 mcc.	Vert.200						1	5	3		1	1	1						12
21 —	B21c	61°14′ N. 2°40′ W.	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100										1								1
22 —	A21b	61°21′ N. 3°10′ W.	2 mcc.	Vert.200																		
22 —	ZZ22c	61°42′ N. 4°51′ W.	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100																		
—	—	—	2 mcc.	Vert.200																		
22 —	YY22b	61°49′ N. 5°21′ W.	2 mcc.	Vert.150				1	1	4	6	4	3	3	2							24
—	YY22a	61°54′ N. 5°45′ W.	1 mcc.	0																		
—	—	—	—	50								2										2
—	—	—	—	100	1						1											2
23 —	XX23d	62°00′ N. 6°12′ W.	2 mcc.	Vert. 85																		
24 —	XX24c	Thorshavn Harb.	2 mcc.	Vert. 18																		
25 —	XX23d	62°12′ N. 6°11′ W.	2 mcc.	100	Collection discarded																	
—	—	—	1 mcc.	0																		
—	—	—	—	50	No collection (net burst)																	
—	—	—	—	100																		
25 —	YY23a	62°20′ N. 5°55′ W.	2 mcc.	Vert.130																		
—	—	—	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100																		
25 —	XX24c	62°34′ N. 6°37′ W.	2 mcc.	Vert.140																		
—	—	—	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100																		

Date	Area	Position	Net	Depth m.	No. and sizes of **Herring** Larvae mm. 13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Total
May	WW23a	62°16′ N. 7°32′ W.	2 mcc.	Vert.105																		
—	—	—	1 mcc.	0																		
—	—	—	—	50					1	1	2											4
—	—	—	—	100																		
—	WW22b	61°46′ N. 7°11′ W.	2 mcc.	Vert. 85																		
—	—	—	1 mcc.	0																		
—	—	—	—	45																		
—	—	—	—	90																		
—	XX22c	Trangisvaag Harb.	1 mcc.	0																		
—	—	—	—	13																		
—	—	—	—	26																		
—	XX22d	61°32′ N. 6°28′ W.	2 mcc.	Vert.128																		
—	—	—	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100																		
—	XX21a	61°17′ N. 6°58′ W.	2 mcc.	Vert.140																		
—	—	—	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100																		
—	WW21d	61°09′ N. 7°24′ W.	2 mcc.	Vert.200					1	1												2
—	—	—	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100																		
—	WW21c	61°02′ N. 7°50′ W.	2 mcc.	Vert.200																		
—	VV20b	60°54′ N. 8°16′ W.	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100																		
—	WW20c	60°35′ N. 8°00′ W.	2 mcc.	Vert.200																		
—	WW19c	60°12′ N. 7°40′ W.	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100																		
—	WW18b	59°56′ N. 7°27′ W.	2 mcc.	Vert.200																		
—	—	—	1 mcc.	0																		
—	—	—	—	50																		
—	—	—	—	100															1			1
—	XX17c	59°00′ N. 6°40′ W.	2 mcc.	Vert.125																		
—	—	—	1 mcc.	0								1	2		1							4
—	—	—	—	50																		
—	—	—	—	100																		
—	XX15b	58°17′ N. 6°12′ W.	1 mcc.	0																		
—	—	—	—	16																		

Notation. 1 mcc. = 1-metre Cheesecloth: Horizontal hauls, duration 15 minutes.
2 mcc. = 2-metre Ring Net, Vertical.

PLATEAU CONTINENTAL ATLANTIQUE ET COMITÉ ATLANTIQUE

1937.

Par

Ed. le Danois.

A. Plateau Continental Atlantique.

Les Gouvernements intéressés par les recherches du Comité du Plateau Continental Atlantique ont effectué dans le courant de l'année 1937 les croisières et recherches suivantes:

Espagne.

Aucune croisière par suite des évènements politiques actuels.

France.

Par suite de réparations, le navire de recherches "Président Théodore Tissier" n'a pu prendre la mer pendant l'année 1937.

Les résultats scientifiques des croisières de 1936, particulièrement les études de la Côte Occidentale d'Afrique ont fait l'objet de 3 fascicules de la *Revue des Travaux de l'Office des Pêches Maritimes*; l'étude du materiel recueilli fera l'objet de publications ultérieures en 1938.

L'Aviso de la Marine Nationale "Ville d'Ys" a effectué des observations hydrologiques en 1937 sur les bancs de Terre-Neuve et au Groënland. Les listes des stations ont été communiquées au Comité du Secteur Nord-Ouest.

Les Avisos "Quentin-Roosevelt" et "Ailette" ont procédé à diverses recherches dans la zone d'action du Comité au sud-ouest des Iles Britanniques.

Grande-Bretagne.

Les travaux sur le merlu ont été continués à Fleetwood et Milford, particulièrement en ce qui concerne les quantités pêchées et les tailles des poissons. Il faut noter que les armateurs de Milford ont adopté la méthode de pêche espagnole en utilisant le filet appelé "pareja". Les effets de ce nouvel engin sur le stock du merlu sont étudiés par le Service Anglais.

Les études sur la sardine de Cornouailles sont en bonne voie de continuation et feront l'objet de publications dans le courant de la présente année.

Le navire "Salpa" de la Marine Biological Association a effectué des sorties périodiques entre Plymouth et la station internationale E. I. pendant les mois de Janvier, Février, Avril, Mai, Juin, Juillet, Août, Septembre et Décembre. Les renseignements recueillis ont été envoyés directement au Bureau Central du Conseil.

Irlande.

Le navire de recherches "Muirchu" a procédé à 3 sorties pour des études hydrologiques et planctoniques sur la côte nord d'Irlande, en Février, Mai et Août.

Portugal.

En continuation du programme de recherches entreprises depuis la fin de 1936 l'"Albacora" a effectué 7 sorties au large de l'embouchure du Tage au mois de Février, Avril, Mai, Juin, Août, Septembre et Décembre et des observations dans l'estuaire du fleuve au mois de Novembre à l'occasion d'une crue anormale.

Le navire qui était affecté au Service de la Marine de Guerre a été remis à l'Administration de la Station Biologique de Lisbonne au mois d'Octobre 1937. Il va faire l'objet de réparations et de nouveaux aménagements y compris l'installation d'un sondeur "ultra-sonore".

Conformément au voeu émis par le Comité du Plateau Continental Atlantique à sa séance du 16 Juillet 1937, un sous-comité avait été constitué pour l'étude d'une technique concernant les recherches sur le maquereau. Les membres de ce sous-comité étaient MM. Kemp (Angleterre), Farran (Irlande), Le Gall (France), Ramalho (Portugal), Schnakenbeck (Allemagne).

Ce sous-comité s'est réuni au Laboratoire de Plymouth et y a tenu ses séances les 8 et 9 Décembre 1937.

Le Comité du Plateau Continental Atlantique tient à adresser à ce sujet ses remerciements au Professeur Stanley Kemp pour l'hospitalité qu'il a bien voulu offrir à ses membres.

Le compte-rendu des travaux du sous-Comité pour l'étude du maquereau figure comme annexe au présent rapport.

B. Comité Atlantique.

Le Conseil International des Pêcheries de l'Amérique du Nord a tenu sa réunion annuelle au mois de Septembre 1937 à Montréal.

Le Conseil a pris connaissance des études effectuées du côté européen sur les variations en abondance de certaines classes annuelles de poissons comestibles et a décidé la continuation de ses recherches du côté américain. Il a, de plus, entendu diverses communications concernant les variations d'abondance du saumon sur la côte orientale.

Les investigations touchant l'églefin ont fait l'objet d'un rapport général de H. Herrington. De même, le Conseil a pris connaissance d'un rapport de M. Sette sur le maquereau. Le matériel étudié porte sur 10 années d'observations de 1926 à 1935. On doit à M. MacKenzie un exposé détaillé des recherches sur le merlu effectuées par le Gouvernement Canadien et portant particulièrement sur l'étude des races locales et les variations de croissance aux différentes températures.

Les croisières hydrologiques de l'"Atlantis" appartenant à l'Institution Océanographique de Wood's Hole ont fait l'objet d'un rapport détaillé de M. Iselin sur les conditions océanographiques de l'Atlantique Occidental, comportant certaines conclusions sur les rapports entre l'hydrologie et les recherches sur la pêche.

MACKEREL SUB-COMMITTEE

Meeting held at the Plymouth Laboratory of the Marine Biological Association at Plymouth, 8th and 9th December, 1937.

Agenda.

1. Methods of Sampling and Selective Action of Nets.
2. Biometrical Data: (a) Length. (b) Vertebral Counts. (c) Other Data.
3. Food.
4. Age Determination: (a) By Otoliths. (b) By Scales. (c) Interpretation of Readings.
5. Stages of Sexual Maturity.
6. Plankton and Hydrographical Observations: (a) Standardization of Methods of Collection. (b) Data required from Plankton Collections. (c) Possible Collaboration in Work at the Mouth of the Channel.
7. Collection of Early Metamorphosed Stages.
8. Commercial Statistics.
9. Other Researches proposed.
10. Demonstrations.

Delegates present:—

Mr. G. P. Farran	Irish Free State.
Dr. J. le Gall	France.
Dr. Stanley Kemp	England.
Dr. A. Ramalho	Portugal.
Prof. Dr. W. Schnakenbeck	Germany.

Dr. E. S. Russell, Dr. E. J. Allen, Mr. E. Ford, Dr. D. L. Serventy (Australia), Mr. G. A. Steven, Mr. P. G. Corbin and Captain W. Nellemose, the Administrative Secretary, were also present and took part in the work of the meeting.

Proceedings.

Dr. S. Kemp was elected Chairman. He welcomed the delegates to Plymouth on behalf of the Council of the Marine Biological Association.

After a brief preliminary statement by Mr. G. A. Steven concerning the mackerel researches which are already being carried out by the Plymouth Laboratory, the delegates proceeded to consider points set out in the agenda.

1. Methods of Sampling and Selective Action of Nets.

After some discussion it was agreed that selection, to a greater or less extent, is inevitable with most fishing gears. Trawls and seine nets exercise a minimum of selection. Most seines are restricted to fishing in shallow water. The trawl takes a true sample of fish only at the depth at which it is working; other fish may be present in the same place but at other depths and so evade capture by the trawl.

It was agreed that little could be done to obviate this difficulty of true sampling, except to impress upon all workers on fishery subjects the necessity of grasping every opportunity which may arise of obtaining useful data on selective action.

The Sub-Committee recommend that biometric and other data on mackerel caught at as many points as possible along both the English and French coasts of the Channel should be collected, since valuable information on growth and migrations might be obtained by this means.

2. Biometrical Data.

(a) Length.

The Sub-Committee recommend:—

(I) that mackerel be measured in the same manner as has been adopted by the International Council for herrings:— i.e., measurement to be made to the nearest centimetre below. The mean of the length-groups so obtained will thus be taken as half a centimetre above the reading;

(II) that the longest measurement of the fish be used — i.e., from the snout to the end of the longer fluke of the tail when the flukes are extended in alignment with the middle line of the fish.

(b) Vertebral Counts.

After discussion it was agreed that the only variant at present known which is likely to provide useful data upon the question of race is *the number of thoracic vertebrae with open haemal arches.* (When the arch is absent or not fully closed it is to be regarded as "open").

The Sub-Committee recommend that this character should receive further study and that the delegates should if possible procure samples of vertebrae from their own areas (including the North Sea) for comparison with those obtained at Plymouth. If it should prove impracticable to examine the vertebrae in laboratories of the countries concerned samples may be forwarded to Plymouth for report.

(c) Other Data.

Dr. le Gall laid before the Sub-Committee a detailed statement of numerous other groups of biometrical data which he had collected. From the point of view of racial discrimination these had yielded completely negative results, and the Sub-Committee therefore resolved that no biometrical data other than those set forth above need be collected.

3. Food.

The Sub-Committee recommend that stomach contents be examined with a view to ascertaining whether any particular organism or organisms are definitely selected for food. It was suggested that plankton indicators, similar to those used by Prof. A. C. Hardy, and small townets worked by fishermen might usefully be employed to provide corroborative data.

4. Age Determination.

(a) By Otoliths.

Otoliths can be read in young fish up to about 30 cm. in length. At present the interpretation of the readings is conjectural, but it is to be expected that the relation between the number of rings and the age of the fish will before long be solved.

The Sub-Committee recommend that delegates should collect otoliths from samples of fish caught in their own and other areas for comparison with Plymouth material, the examination of the otoliths in conjunction with the lengths (and possibly the skeletons) of the fish from which they were taken to be made, if possible, in the laboratories of the countries concerned.

(b) Scales.

The difficulty of obtaining uncontaminated scale samples from any but line-caught fish is almost unsurmountable. It has been found, however, at Plymouth, that a proportion of the scales are readable and that they give readings in agreement with those from the otoliths. It is thought that the only method of obtaining reliable scale-samples is to drop line-caught fish directly into paper bags without touching them by hand.

(c) Interpretation of Readings.

It was agreed that the interpretation of otolith and scale readings will be greatly facilitated, and may perhaps only become possible, when the missing young stages of the fish have been found and their growth studied.

5. Stages of Sexual Maturity.

Mr. Steven gave a detailed account of the difficulties he had experienced in determining stages of maturity. The first indications of full maturity are ripe eggs which appear on the outside of the ovary, widely scattered among unripe eggs ("plum-pudding" stage). Later these ripe eggs pass into the lumen of the ovary which, externally, then reverts to the appearance of Stage V. This condition recurs, possibly many times, before the ovary is spent.

After discussion it was agreed that the maturity stages decided upon by the International Council as applicable to the herring ovary may also be applied to the mackerel ovary up to and including Stage V, but that Stage VI of the herring scheme is not applicable because the eggs in a mackerel ovary do not all ripen at once. The Sub-Committee recommend that the "plum-pudding" stage be designated Stage VI*a*; all later stages to be VI*b* until all the season's eggs are shed, when the fully spent ovary shall be designated Stage VII, as in the herring.

6. Plankton and Hydrographical Observations.

(a) Standardization of Methods of Collection.

The delegates recommend that a 2-metre stramin ring trawl seven metres in length should be used for the collection of plankton samples, and that a single oblique haul, lasting half an hour, should be taken at each station. The net should be towed (speed: 2 knots) for 5 minutes at each of the depths shown below, beginning at the surface:—

Surface							5	mins.	½ hour
10	fms.	(18	m.)	of	warp	out	5	—	
20	—	(36	-)	-	—	-	5	—	
35	—	(63	-)	-	—	-	5	—	
50	—	(91	-)	-	—	-	5	—	
70	—	(126	-)	-	—	-	5	—	

It was also decided to recommend that for the collection of relevant hydrographical data the Nansen-Pettersson water bottle be used at the following depths:— 0, 5, 25, 50 metres, and at bottom. Temperatures and salinities should be recorded and phosphate content determined when possible.

(b) Data required from Plankton Collections.

The Sub-Committee agreed that apart from mackerel eggs and larvae it would only be necessary to record a small number of the plankton organisms obtained

in the nets. It was felt that results could more easily be standardized if similar analysis sheets were used by the countries participating in the work, and a form which gives details of the methods employed at the Plymouth Laboratory is therefore appended. This form goes somewhat beyond the essential requirements for mackerel research, and some of the entries may be omitted if sufficient time for a fuller examination is not available. It is suggested that the species of *Sagitta* should be counted and that the absence or abundance of other organisms should be indicated by symbols. For stages in the development of mackerel eggs the definitions given by F. S. Russell, Journ. Mar. Biol. Assoc., XIV, p. 138 (1926), may be used.

(c) Possible Collaboration in Work at the Mouth of the English Channel.

The possibility of collaboration in plankton and hydrographical work on the mackerel grounds west of the Channel and to the south of Ireland was discussed. The Sub-Committee was impressed with the importance of obtaining simultaneous observations over a wide area and Dr. le Gall and Mr. Farran expressed the hope that their Governments would cooperate with the Plymouth Laboratory in joint cruises to be undertaken in the spring of 1938, preferably in April.

7. Collection of Early Metamorphosed Stages.

Discussion tended to show that the missing stages in the life-history of the mackerel (between 1·5 and 9 cm.) are not likely to be found close inshore. The Sub-Committee felt that every effort (including extensive examinations of stomachs of fish from likely areas) should be made to find these small mackerel.

8. Commercial Statistics.

The meeting was agreed that more information concerning the effects on landings of non-biological factors, such as market and weather conditions, is desirable for the better interpretation of official statistical returns; but it was recognised that such information cannot easily be obtained, and that it must be left to each worker to collect information on these points.

9. Other Researches.

(a) Dr. Ramalho suggested that if the vertebral variant described under 2(b) above were found to yield negative results, the character "degree of openness of the haemal arches" on vertebrae 8—11 might be studied.

(b) Mr. Steven mentioned the difficulty of distinguishing the eggs, larvae, and post-larvae of *Scomber colias* from those of *S. scombrus*. Dr. Ramalho stated that these two species of mackerel are about equally common in Portuguese waters and he promised to examine eggs and larvae in order to find distinguishing characters.

(c) Dr. le Gall drew attention to the highly important fact that, in his experience, shoals of herring and mackerel frequently appear on or near the same trawling ground, separated by distances usually of only a few miles. It was suggested that further study of this phenomenon might prove fruitful.

(d) A résumé of his work on the biology of the mackerel, kindly prepared for the meeting by Dr. le Gall, was received. The Chairman thanked Dr. le Gall for the trouble he had taken in preparing this document, and it was recommended that it should be printed with the minutes of the meeting.

(See page 25.)

On completion of the ordinary business of the meeting some of the apparatus devised at the Plymouth Laboratory for mackerel research was shown to the delegates and its uses demonstrated.

(Plankton Sheet on p. 24.)

PLANKTON SAMPLE

Record Sheet.

Ship.....

Station No..... Sounding..... (Metres)

Date ..... Time ..... (G.M.T.)

Position { Lat.....
Long.....

Gear used.....

Duration of fishing .....

Maximum warp out ..... (Metres)

Naturalist on board.....

Number of FISH EGGS .....

Number of PILCHARD EGGS .....

Number of MACKEREL EGGS

Stage	—0	1/4	1/4+	1/2	3/4	1	Total

Number of MACKEREL LARVAE .....

Number of MACKEREL POST-LARVAE
in half-millimetre length-groups (next below).

3·0	9·0	15·0 .....
·5	·5	·5 .....
4·0	10·0	16·0 .....
·5	·5	·5 .....
5·0	11·0	17·0 .....
·5	·5	·5 .....
6·0	12·0	18·0 .....
·5	·5	·5 .....
7·0	13·0	19·0 .....
·5	·5	·5 .....
8·0	14·0	20·0 .....
·5	·5	·5 .....

TOTAL POST-LARVAE .....

Weather .....

Wind { Direction .....
Force ..... (Beaufort Scale)

Colour of Water .....

Temperature of Air ..... °C

Temperature of Water { Surface ..... °C 50 m..... °C
5 m..... °C ..... °C
25 m..... °C Bottom..... °C

Salinity { Surface ..... ‰ 50 m..... ‰
5 m..... ‰ ..... ‰
25 m..... ‰ Bottom..... ‰

	Scarce	Abundant	Very abundant
ZOOPLANKTON			
PHYTO-PLANKTON			

ZOOPLANKTON

	Number	%
Sagitta elegans		
Sagitta serratodentata		
Sagitta setosa		

Aglantha	*Themisto* .....
Liriope	*Calanus* .....
Laodicea	*Metridia* .....
Cosmetira	*Anomalocera* .....
Muggiaea	Euphausiids .....
Limacina	Salps .....
Clione	Doliolids .....

other outstanding organisms { .....
.....
.....
.....

Signature.....

APPENDIX

Résumé des Recherches entreprises en France sur la Biologie du Maquereau (*Scomber scombrus* Linné).

Par

Jean le Gall.

Organisation des Recherches.

Distribution générale, lieux et époques de pêche. Examen des statistiques des ports et marchés. Relevé des feuilles de pêche; enquêtes sur les lieux de débarquement du poisson et sur les pêcheries. Embarquements sur les garde-pêche de la Station Navale de la Mer du Nord et de la Manche et sur les bateaux de pêche.

Conditions physico-chimiques du milieu. Etude de la température et de la salinité des prélèvements d'eau effectués sur les pêcheries du large (concentrations de prématurations ou de ponte) et les pêcheries côtières (période de dispersion trophique).

Observations faites à bord des garde-pêche "Quentin Roosevelt", "Estafette", "Sentinelle", "Pétrel", des navires océanographiques "Tanche", "Président Théodore Tissier", des drifters et des chalutiers des flottilles de Boulogne ou de Douarnenez. Ces observations ont principalement porté sur les pêcheries situées en Manche, à l'entrée occidentale de cette mer, au sud de la Mer d'Irlande, au nord de l'Irlande (Klondyke—Inishtrahull) puis, en Mer du Nord sur les pêcheries des accores de la Mer Norvégienne, du Fladen, du Dogger Bank et du Sud de la Mer du Nord.

Les observations (températures et salinités) ont été faites en surface, à différentes profondeurs et sur le fond.

Conditions biologiques du milieu. Pêches de plancton au filet fin, en surface et en profondeur, faites en même temps que les prélèvements d'eau et l'examen de la température, au cours des différentes sorties entreprises.

Examen des pêches planctoniques fait en comparaison des contenus stomacaux des maquereaux capturés dans les mêmes régions.

Caractères morphologiques de *Scomber scombrus*. Mensurations sur les marchés et les pêcheries. Taille: Distribution suivant la taille. Age: Prélèvements d'écailles et d'otolithes. Proportions du corps et établissements des indices biométriques. Moyenne vertébrale.

Caractères physiologiques de *Scomber scombrus*. Maturité sexuelle (stades établis de I à VIII suivant l'échelle de Hjort adoptée pour le hareng). Contenus stomacaux des individus capturés aux différentes époques de l'année. Etude de la nourriture du Maquereau.

Les Résultats obtenus.

Distribution générale. Distribution saisonnière. Les observations faites ont permis l'établissement de cartes mensuelles indiquant la distribution du maquereau sur les côtes de l'Atlantique et de la Manche et de la Mer du Nord.

(a) L'examen de ces cartes montre que les bancs de maquereaux apparaissent tout d'abord aux accores du Plateau Continental (parages de la Grande Sole; accores de la Mer Norvégienne près du Banc Viking) dès le mois de Février.

Ces premières concentrations de maquereaux sont des concentrations de prématuration *sur le fond*, généralement vers 150 mètres. Les bancs se dirigent ensuite vers les frayères de l'espèce; et, en même temps, se déplacent verticalement de bas en haut pendant la nuit et de haut en bas au petit jour. Ces déplacements verticaux se constatent dès le mois de Mars en Atlantique; plus tardivement, Avril—Mai en Mer du Nord.

(b) La présence de frayères à l'entrée du Skagerak, au sud de la côte norvégienne, montre que les maquereaux de la Mer du Nord, *contrairement à l'opinion précédemment émise*, constituent un Stock indépendant des maquereaux de l'entrée occidentale et de la Manche qui ont leurs frayères propres à l'entrée sud de la Mer d'Irlande et à l'entrée occidentale de la Manche.

Les déplacements de ces deux Stocks indépendants ont pu être suivis depuis leur première concentration de prématuration sur le fond jusqu'à leur concentration sur les frayères.

(c) Après la ponte, les maquereaux se dispersent (période de dispersion trophique), les individus ayant pondu gagnent les eaux continentales ou côtières:

Dans le Skagerak et le Kattegat, sur les bancs peu profonds de la Mer du Nord (Stock de la Mer du Nord);

Zone littorale en Manche et sur les côtes de l'Atlantique (Stock atlantique).

(d) Dans certaines conditions, une concentration de nutrition sur le fond a pu être observée: Région des Smalls, d'Inishtrahull, du Fladen, d'Utsire, Baie de Plymouth.

Ces concentrations sont généralement voisines d'importantes concentrations de harengs.

(e) Dès l'approche de l'hiver (abaissement de la température), les bancs de maquereaux regagnent les eaux profondes ou les accores du Plateau Continental.

Les chalutiers les y retrouvent (Décembre, Janvier, Février: accores de la Mer du Nord; Janvier—Février: accores du Plateau Continental Atlantique.)

Conditions physico-chimiques du milieu. Les concentrations de prématuration et de ponte paraissent généralement se faire dans des eaux de caractère atlantique à salinité élevée (supérieure à 35 $^0/_{00}$ en Atlantique).

Les déplacements des bancs à l'entrée occidentale de la Manche et à l'entrée sud de la Mer d'Irlande paraissent se faire principalement suivant les *axes transgressifs* se manifestant par une salinité et une température élevées (salinité supérieure à 35 $^0/_{00}$, température variant de 10° à 15° suivant l'époque de l'année).

Ponte. La ponte se fait également dans ces eaux transgressives, les oeufs et les larves de maquereau étant nettement plus abondants dans les pêches planctoniques faites dans ces eaux.

Après la ponte (période de dispersion trophique) les conditions de température et de salinité semblent ne plus avoir d'influence sur les déplacements du maquereau.

Nourriture. Les recherches sur la nourriture confirment les recherches antérieures: Nourriture essentiellement planctonique, portant sur le plancton végétal (Diatomées, Algues Vertes) en début de saison Février—Mars; puis, sur le plancton animal: Copépodes, Schizopodes: Avril, Mai, Juin. Après la ponte, le régime devient extrêmement varié, principalement carnivores: Crustacés du plancton, Ptéropodes, Larves et jeunes poissons).

Caractères morphologiques. Les proportions du corps établies, sous la forme d'indices biométriques, les caractères numériques: (nombre de rayons aux nageoires, nombre de vertèbres), ne permettent pas d'établir une différence nettement caractérisée entre les individus provenant de la Mer du Nord, de la Manche ou de l'Atlantique.

La moyenne vertébrale (= 31) est étonnamment fixe.

Les indices biométriques établis ne varient que dans de faibles limites quelles que soient la taille (ou âge), l'origine des échantillons examinés.

L'espèce *Scomber scombrus* Linné montre une fixité remarquable des caractères étudiés.

Seuls, les caractères physiologiques (maturité sexuelle), des époques et des aires de ponte nettement distinctes, permettent d'admettre la possibilité de Populations géographiques distinctes mais extrêmement voisines quant à leurs caractères morphologiques.

COMBINED NORTH SEA AND EASTERN CHANNEL COMMITTEE

1937.

By

G. Gilson.

The region between the English Channel and North Sea has been actively studied in 1937, as previous years, from research ships, trawlers, and ghtships; some of the data obtained in the various vestigations will be found in the Council's Reports in papers published in the countries concerned. is more than ever desirable that all kinds of phyal and biological observations should be made eriodically in the area by a number of scientific ips operating simultaneously along certain fixed nes; moreover, all observations should be rapidly orked out and the results made immediately availble both for scientific computation and for supying practical directions for the fishery in the gion. Unfortunately, the fulfilment of this ideal volves greater difficulties than had been expected. he scientific staffs, ships and gear of the various boratories can not always take part in collective ork at fixed times and places, such as was done uring the early years of international exploration, ithout interfering with individual work or local vestigations. On the other hand, the exclusive nployment of special ships and staff would involve great an expenditure that a sufficient grant would arcely be obtainable in any country at the present ne. Nevertheless, we must not give up the hope at some day the completeness of the scheme will appreciated and that the necessary means for tion will be provided by the Governments, perps with the assistance of some of the patrons of ience. In the meanwhile it seems that the nearest proach to achievement of the plan would be made by international arrangement all kinds of data llected in the intermediate region could be stored material for future studies of the physical, biolo-al, and meteorological conditions that have prelled during certain periods in our waters. For work of this kind, and even for charting observations in ordinary cruise work, the charts issued by the Brussels Museum, containing vertical sections, are again recommended.

The work carried out this year in the region may be described under the following headings:

Biology.

Herring. As before, the two groups of southern herring in the Channel, in the southernmost part of the Flemish Sea, and also in the English coastal waters have been studied during the fishing season mainly by the Station Aquicole, Boulogne, and the Fisheries Laboratory, Lowestoft. Material has been collected for the study of the relations of these two groups and also of more northern herrings with the very interesting concentration of pure spents that occurs every winter along the continental coast between Cape Grisnez and the Scheldt. This shoal of spent herrings has been constantly watched during the last eight years at the Ostend Laboratory. Knowledge of the exact localities where these spents have spawned is now urgently required but nothing can be done to obtain it without the use of a well-equipped ship that could be maintained at work in the region for sufficient time. No such ship is at present available at Ostend, the laboratory being in a state of complete renovation.

Attention has been paid to the influence of hydrographical and meteorological conditions on the movements of southern herrings, especially the seasonal migration of the spents to their annual resting ground off the French and Belgian coasts. Certain biological irregularities have appeared, for the first time, in the 1937—38 season just closed. The 3-year-old herrings, born in 1933, made their first appearance on

the coast, in 1937, in rather low proportion, 15 %. This year, 1937—38, in their second appearence, aged 4 years, the percentage, instead of going up, in conformity with the ordinary rule, has sunk to 12 %. The cause of this is probably to be found in a peculiar combination of physical conditions (see the paper by J. N. Carruthers and W. C. Hodgson — Cons. Internat. Rapp. et Proc.-Verb. Vol. CV, 1936—37).

Other fish. Investigations on other fish, particularly **plaice** and **sprat**, started in previous years, have been continued throughout the short administrative period July 1937—February 1938, mainly in France, England, Holland and Belgium. All of them extended into the intermediate region and the Southern North Sea area. The results will be found in the report of the Southern North Sea Committee and in special publications. It may be mentioned that on the Belgian coast the sprat fishery was a complete failure. The shoals kept too far out for small craft and were sparse. Moreover, the fish were so small that they could very often not be marked and sometimes the fishermen preferred throwing their small catches overboard to sorting out the few really marketable fish. Nevertheless, the methodical analysis of one kilogramme out of the catch of each fishing day was continued as long as the fishing lasted.

Shrimp. The study of the local fishery was continued and laboratory work (including aquarium rearing) was done on the biology of *Crangon*. A motor boat with an experienced crew of shrimpers will be chartered for ethological and technical investigations.

Hydrography.

Observations have been made at various lightships, including the Varne, Sandettié, Smith's Knoll, and West Hinder. Research ships have contributed temperatures and salinity samples at various depths on the sections Dunkerque—Dover, Boulogne—Newhaven, Ostend—Gravelines—Deal, with surface observations elsewhere. Numerous data, including the very important English ones, have been communicated to the Hydrographical Committee.

Plankton.

Huge quantities of plankton have, as usual, been taken from our waters, especially at the lightships Varne, Galloper, Sandettié and West Hinder, as well as by the research ships of France, England, Holland, Germany, and Belgium. The samples taken with the Hardy plankton indicator at the four stations on the section Deal—Gravelines were sent for analysis to Hull, where the principal species were identified and counted.

Fish-Eggs and Larvae.

Eggs and larvae were collected from the plankton samples obtained on all cruises and at lightships, and preserved for further study. Dr. Bückmann mentions that on a cruise in March 1937 in the German Bight small larvae, very likely hatched in December or January, were predominant, the larger ones, apparently hatched in November 1936, being extremely rare, a fact that must be taken into account in the study of the movements of herring larvae hatched in the Flemish Sea as far south as the line Sandettié—East Goodwin, where they had been found by the same observer to be very abundant in December 1936.

Simultaneous cruises made periodically in various parts of the region Channel—North Sea would settle the question of the fate of young herrings hatched in the south and of the relations between Channel herrings and the northern communities.

NORTHERN NORTH SEA COMMITTEE

1937.

By

Robert S. Clark.

Introduction.
I. Work at Sea.
II. Hydrography.
III. Plankton.
IV. Fisheries (a) Ichthyometrics.
(b) Fishing Technique.
V. Fish (a) Herring.
(b) Haddock.
(c) Plaice.
(d) Lemon Sole.
(e) Mackerel.
(f) Ling.
VI. Shellfish (a) Lobsters.
VII. Bottom Fauna.
VIII. List of Papers issued during the year on work within the area.

INTRODUCTION

There has been little change in the scope and organisation of the scientific work within the area during recent years. Herring and haddock, the chief food fishes, continue to occupy most attention and the continuity of the observations has thereby been maintained. The programmes for the collection of data at sea were carried out with certain modifications and some progress was made on the lines of the recommendations put forward at last year's meeting in Copenhagen. All the countries represented on the Committee participated in the general scheme of work and the contributions by their representatives are incorporated in the following pages. Scottish research vessels are able to carry out regular and continuous surveys of the area, but the less frequent visits of the vessels of other countries yield data which have proved invaluable in confirming and extending the results of the investigations, especially in the eastern sector of the North Sea. The value of co-operation between the various countries in the solution of particular problems within the area has again to be stressed. The varying hydrographical and planktonic conditions are of particular interest to all countries bordering on the North Sea and the intensive co-operative work in the northern area is absolutely essential for the proper understanding of the distribution, movements, growth and fluctuations in abundance of the more important food fishes. The usual methods have been adopted in the study of herring, haddock, plaice and lemon soles, and further progress has been attained. The effect of fishing operations on the demersal stocks has received special attention, the statistics of landings of the various categories being utilised in conjunction with more detailed measurement data and age determinations for a critical study of the position of the fisheries. Examination of commercial samples continues to form the basis of the research work on herring and the recent advances regarding the various types and communities present in northern waters have cleared up many obscure points which can now be put to practical advantage.

The haddock forecasts of recent years have proved remarkably accurate and this service has been continued. The present position of the haddock stock and prediction as to the future yield are outlined later in this report. Surveys of the small plaice populations in the shallow coastal waters and of lemon soles have received renewed and extended attention. A close watch is being kept on the lobster fisheries round the Scottish coasts by means of measurement data of representative samples at different localities and by examination of the general statistics of landings. Investigations on bottom fauna have been continued with special reference to the amount of food available for maintenance and growth of the more important food fishes.

I. WORK AT SEA

Denmark.

The motor vessel "Amy" operated the shrimp trawl at one station (59°00′ N. 1°20′ E.) at a depth of 110 metres during a voyage to the Faroes in July. The new research vessel "Dana" was not in commission during the year.

England.

No observations were made in the area from the research vessels "George Bligh" and "Onaway".

France.

The fishery patrol vessel "Ailette" again carried out sectional hydrographic and plankton observations during cruises to the Iceland and Murman coast cod fisheries from May to August. Serial hydrographical observations were also made on the herring and mackerel grounds of the Northern North Sea by the patrol vessels "Ailette" and "Quentin Roosevelt" from June to September.

Germany.

Two cruises were made in June and July with a steam trawler to the Fladen Ground to investigate the herring trawl fishery. In May—June and June—July, investigations on drift net herring were carried out on board the fishery protection vessels "Elbe" and "Weser".

Holland.

The "Nautilus" operated in the Northern North Sea across the Fladen ground at the end of June.

Norway.

The "Armauer Hansen" carried out the following traverses during April and May:—

Norway—Peterhead.
Peterhead—Shetland.
Shetland—Norway.

Scotland.

The research vessel "Explorer" carried out nine cruises during the period March to December. The areas traversed included the greater part of the North Sea, with the exception of the extreme south and south-eastern regions, and the north and west coasts of Scotland within the continental plateau. Extensions were effected in May across the Faroe—Shetland Channel to the Faroes, and in June over the deep water to the Norwegian coast. As in previous years, the investigations were of a general nature and involved the study of the sea itself, its physical and chemical properties and the movements of the water masses. Surveys were also made of minute and larger floating organisms, both plant and animal, present in the different water masses at different levels and at all seasons of the year for correlation with the sea conditions and with the movements of herring shoals, while the usual detailed analyses of the fish stocks — herring, haddock, lemon sole and plaice — formed a major part of each of the programmes of work. The new motor research vessel "Kathleen" started operations in June, supplementing the offshore work from the larger vessel by investigation of the shallower waters of the bays and estuaries. The "Kathleen" is fitted out for trawling and seining and is admirably adapted, with her shallow draught, for surveying the small fish populations within the exclusive fishery limits.

Investigation of the inshore nursery areas along the east coast of Scotland was resumed and was extended to include the north coast of Scotland and the coast line south of the Firth of Forth to the Northumberland coast.

Sweden.

The "Skagerak" operated in the Northern North Sea, in the Faroe—Shetland Channel and at the Faroes from the middle of July to the middle of August.

II. HYDROGRAPHY

France.

Temperature and salinity observations were made during the usual cruises of the "Ailette" and "Quentin Roosevelt" from May to September.

Holland.

Serial observations were taken at nine stations between the Orkneys and Utsire at the end of June.

Norway.

From April 12th to May 7th, 139 oceanographical stations in a series of sections were executed in the Northern North Sea and the adjacent waters of the Norwegian Sea by the Fisheries Directorate by means of the research vessel "Armauer Hansen" which was hired from the Geophysical Institute, Bergen. The positions of the four sections (100 stations) between Norway and Peterhead and Balta, Shetland, as well as of the few stations between Peterhead and Orkney and between Orkney and Shetland were almost the same as those in the spring of 1936.

The "Johan Hjort" and the "Armauer Hansen" carried out observations at 57 stations in the Norwegian coastal regions and the Norwegian Channel from January to March and during September to October.

The sea-thermograph services between Bergen and Newcastle, Stavanger and Rotterdam and Bergen and Iceland were continued as in previous years except the Newcastle service which was run only to the end of October as the thermograph had to be taken ashore for repairs.

Water samples were collected on four cruises in February, May, August and November.

Scotland.

A summary of the Scottish investigations will be found in the report of the Hydrographical Committee. Since this report was written, however, a flood of drift bottle recoveries has been experienced from the region of the Skagerak. From the end of January to the middle of February 1938, no fewer than 200 recoveries were recorded, mainly in the Skagerak region. These more recent drift-bottle results indicate that, while maximum intensity of the oceanic incursion into the Northern North Sea between Shetland and Norway was not reached until probably the month of August, the intensity thereafter rapidly declined towards a minimum in November or early December. It seems practically certain that the recent concentration of recoveries on Skagerak shores, together with other related results, denotes a fairly rapid recovery from minimum intensity of the oceanic influx and a marked accession to its strength towards the end of January and in the first half of February 1938. This will almost certainly be reflected in the spring and early summer biological conditions of the northern area. These results furnish valuable information over a period when the research vessel is not in active commission and so provide a link between the investigations of one year and those of the next.

Sweden.

Measurements of "light" penetration were taken near Bressay Shoal during the summer cruise of the "Skagerak" to Shetland waters.

III. PLANKTON

France.

The material collected during previous cruises by the "Président Théodore Tissier", the "Ailette" and the "Quentin Roosevelt" is being worked up. A special study is being made of the various species of Sagitta in the collections.

Germany.

A special apparatus for quantitative catches was constructed and experiments made. The apparatus is fully described in Ber. d. D. W. K., Bd. VIII.

Scotland.

The distribution and abundance of the various floating organisms during the year under review again bring out quite clearly their relationship and dependence on the different water masses and their movements. The unusual sea conditions prevailing during 1937, namely, the lateness of the Atlantic influx into the North Sea in reaching its maximum, the more southerly incursion of boreal water and the extensive westward surface trend of the Baltic effluent explain the occurrence of certain forms within the area and their particular distribution. The absence or scarcity of well-known warm water species is attributable to these factors and during the year there was no great wealth of these forms within the North Sea. An increase, however, of arctic forms in the Northern North Sea, especially during the earlier part of the year, was distinctly noticeable when compared with conditions in more recent years. *Calanus hyperboreus*, for example, which is not indigenous to the North Sea, occurred in abundance in the extreme north and was observed in moderate numbers as far south as the Fladen Ground. The westward spreading of the relatively fresher Baltic water was clearly indicated by the restricted distribution of the pelagic tunicate Doliolum, a warm water species, which was not observed east or south-east of the Gut and by the sharp line of demarcation of two species of arrow worms, one, *Sagitta elegans*, occurring along the western sector in water with an Atlantic mixture, the other, *S. setosa*, in the eastern and southern sectors in purer North Sea water.

Plankton in Relation to the Fisheries.

Calanus finmarchicus, probably the most important food constituent of pelagic fishes in Scottish waters, seemed from the volumetric analyses of the collections to be much less numerous than usual within the North Sea, though its characteristic patchiness was still in evidence. During March, the catches in the Northern North Sea were generally poor, though moderate numbers of a "winter carry over" of later stages and of adults were encountered in the more northern and north-eastern localities chiefly in the region of Viking Bank. Calanus, as is usual, was well represented in the hauls on the continental plateau west of the Orkneys and Shetlands during April and May, being particularly abundant within the Faroe—Shetland Channel. It was observed in abundance in June within the Northern North Sea Plateau only to the north of the 61st parallel, but farther south, within the North Sea, between the Shetlands, the Norwegian Deep and the Aberdeenshire coast, except for isolated patches in Buchan Deep and on Ling Bank, Calanus, young and adult, was weakly represented in the collections during this month. In July, it was scarce in the Central North Sea, the small population consisting mostly of young stages, but a dense local population of adults and copepodid stages was again, as in previous years, encountered in the region of the Berwickshire coast. During the latter half of August, a rich copepod plankton including Calanus was observed on the Fladen grounds. Generally speaking, there was the usual rapid decline in numbers later in the year but fairly dense patches, chiefly of immature stages, were observed in the Longstone area, in Buchan Deep and in the deeper southern gulley of the Moray Firth. The relative scarcity of Calanus during the year emphasised the importance as food forms of the smaller copepods such as *Oithona*, *Pseudocalanus* and *Temora* which frequently occurred in the collections in large numbers.

The abundance of Calanus observed within the plateau along the north of Scotland and to the west of the Orkneys and Shetlands during April and May months was followed by a similar abundance north

and north-east of the Shetlands in June. This richness in copepod herring food did not make itself felt, however, to any appreciable extent within the north-western sector of the North Sea from east Shetlands to the Moray Firth, i. e., on the summer herring grounds during these months when the herring are in search of food. The movements of the herring shoals, therefore, in relation to the food factor were somewhat masked during the year under review and the position was rendered more complicated by the poor drift-net catches which were undoubtedly due to the weak recruitment within recent years of the Scottish autumn-spawning stock. The trawl fishery for the mixed herring populations in the Fladen area, however, was successful.

Plankton in Relation to Hydrography.

The value of certain plankton forms as indicators of particular water masses and their movements has received considerable support in recent years. A study of the various species of arrow worms (Sagitta) has proved interesting and useful in this respect. The Atlantic species (*S. maxima* and *serratodentata*) occurred during the year in the collections off the west and north coasts, but the latter did not penetrate the Inner Hebrides or far into the North Sea. The former was found only at Flugga and east of the Shetlands. The species (*S. elegans*) typical of mixed Atlantic and coastal water was taken in the inshore waters of the west and north coasts and within the western sectors of the North Sea. The species (*S. setosa*) which is indigenous to the North Sea was restricted to the purer North Sea water and was absent from the mixed water of the western sector, along the Scottish east coast. An increased number of cold water forms, e. g. *Calanus hyperboreus*, was observed in the Northern North Sea during the earlier part of the year, thus signifying as in 1935 a more southerly extension of arctic water. The warm water exotics, salps and doliolids, were only observed in small numbers. Salps were represented by the rarer species, *S. asymmetrica* and *Cyclosalpa bakeri*, while the commoner species *S. fusiformis* was entirely absent from the area. *S. asymmetrica* did not penetrate into the North Sea farther than east Shetland waters, while *Cyclosalpa* occurred only off the north of Scotland in the region of Sule Skerry, being the second record of this species in Scottish waters over a period of many years, the previous record being obtained approximately in the same locality at the end of 1932. Disintegrated specimens of doliolids (*D. gegenbauri*) were observed in the area east of Aberdeen Bank to the Gut and west of longitude 1° East in the region of North-East Bank. These occurrences within the western sector of the North Sea are an indication of the effect of the incursion of Atlantic water into the area.

Herring Larvae.

(α) Spring Brood. Large numbers of newly hatched larvae were secured by the "Explorer" west and north of the Shetlands in March, indicating a north-easterly drift past Flugga. At the end of March newly hatched larvae were taken in abundance between Fife Ness and Fluke Hole in the Firth of Forth. The time and place of hatching are annual and regular events. During April, enormous numbers of the smallest larvae were obtained near St. Kilda, thus confirming previous observations as to the extent of spring spawning in this region. Productive spring spawning grounds have also been determined in other years in the region of Stanton Bank, off Barra and at the Flannan Islands, while the largest collections of spring larvae in Scottish waters have been taken along the north coast from the Lewis and mainland sides of the Minch and from Cape Wrath to the Orkneys. The drift of these west and north coast larvae is in accordance with the general trend of the currents, i. e., northerly and north-easterly across the plateau. Some of the larvae hatched west of the Hebrides, however, are transported over deeper water towards the Wyville-Thomson Ridge where conditions for survival are unsuitable, and thus a certain amount of mortality must take place. During May, herring larvae were again secured round the Faroes. These were smaller than the larvae captured during this month in Scottish waters and belonged obviously to a Faroe stock, which spawns slightly later. Larvae in these waters were first observed in the collections by the Scottish research vessel in 1931 and except in 1932 and 1934 when no observations were made, have appeared annually in small numbers chiefly off the eastern side of the Islands.

(β) Autumn Brood. Larvae appeared in the collections in small numbers at the end of August to the east of the Orkneys and off Rattray Head. The numbers increased along the east coast during September but kept offshore and were not carried towards the coast. Apparently the Forth swirl current was operating farther north than usual as larvae were practically absent from the Forth estuary, having been carried past the entrance southwards and south-eastwards. A later wave of hatching was observed in October on the Dogger Bank, at the north-western and south-western corners. During November and December numbers of herring larvae taken within the Forth estuary were almost negligible so that either production had been low, the catches being relatively small everywhere, mortality had been very high, or the larvae had been carried outwith the area, southwards along the English coast or across the Dogger Bank area into the south-eastern sector of the Southern North Sea. Most, if not all, of these larvae will be carried over the winter period still in the unscaled stage and a search for these 'sile' or unscaled stages in English and Danish coastal waters during the spring of 1938 should yield results of considerable value.

Food of Larval Haddock.

The examination of the food contents of the stomachs of over three hundred larval haddock ranging in size from 3·5 to 30mm. taken from the

plankton collections of two successive years 1934 and 1935 has revealed that almost 90 per cent. of the haddock food consists of copepods. Copepod eggs and early larval stages are taken by the smallest fish immediately after the absorption of the yolk-sac and later developmental stages and adult copepods by the larger haddock larvae. The remaining 10 per cent. of the food is made up chiefly of larval molluscs and organisms of the microplankton, especially tintinnids and diatoms and this diet is restricted for the most part to fish under 6 mm. in length. The nauplii or early larval stages of copepods were mostly those of Calanus.

The corresponding Standard Fine Silk collections have been examined, their volumes measured, and counts of the nauplii made. While the volumes of plankton show considerable variation, at no time during the investigations in those two years did there appear to be a scarcity of suitable food for the young fish. It may be noted that 1934 was a poor survival year for the young haddock brood, while 1935, on the contrary gave a rich replenishment to the haddock stock.

Plankton Recording Work.

The continuous plankton recording work carried out by Professor HARDY and his assistants chiefly in the Southern North Sea was extended during the year to include traverses in the Northern North Sea and adjacent waters. For greater facility in dealing with this work from steamers on selected shipping routes in the Scottish area, a branch laboratory was opened in Leith and operations are now in full swing.

Sweden.

A number of plankton hauls was made in the Skagerak region (three stations) and along a line from the Naze to Balta (nine stations). Surface hauls were made at these stations with the ring trawl. No observations were made as in 1936 during the winter months in search of herring larvae as the "Skagerak" was laid up for overhaul during November and December.

IV. FISHERIES

(a) Ichthyometrics.

Denmark.

During a haul of one hour by the shrimp trawl on 6th July at the position 59°00′ N., 1°20′ E., depth 110 metres, 461 haddock ranging from 14 to 39 cm. (mostly between 17 and 26 cm.) were obtained. The measurements and scale material were handed to Scotland for inclusion in the general haddock survey.

England.

The work at sea was continued and included the measurements of 1745 plaice, 80,969 haddock, 16,841 cod and 278 whiting. The data for haddock measured in the Southern North Sea (55,849) were sorted into length frequency distributions and forwarded to Scotland for analysis.

France.

Measurements were again taken of herring and mackerel from commercial vessels fishing in the Northern North Sea.

Germany.

Statistical examination of the herring trawl fishery was instituted to show the course of the fishing as well as the size and age composition of the herring. The results are published in "*Der Fischmarkt*" 1937, Nos. 3 and 4. The regional and seasonal course of the herring trawl fishery has been reported on from the daily catches in the log books. From these, monthly and annual charts have been compiled which are published in Ber. Deutsch. Wiss. Komm. f. Meeresforschung, Bd. VIII. In addition, a beginning has been made with the preparation of a general review of the reports on the annual catches which have been worked up in this way.

Holland.

Measurements and scales from a sample of haddock caught on the Fladen Ground were handed over to Scotland for treatment.

Scotland.

Lobsters.

Measurements of commercial catches were continued at three districts, Soay, Rousay and Burnmouth. In each month from January to November inclusive, samples of the lobster catches landed at Burnmouth (Berwick coast) and Rousay (Orkney) were measured. In the West Coast district of Soay, however, the fisherman-observer, through force of circumstances, did not begin lobster fishing until September and prior to that month other local boats worked only spasmodically. Data, therefore, for the last quarter of the year only are available for this district. Under these circumstances nothing can be said regarding the lobster stock on Soay grounds during 1937.

The data for Burnmouth appear to be of particular interest in that for the first time since these observations began in 1931, there is an indication that an accession to the stock of some magnitude has occurred. The relative percentage numbers at the lower size-groups for the different years are as follows:—

	1931	1932	1933	1934	1935	1936	1937 (11 months)
8″ and under 9″	12·6	9·1	6·9	2·9	7·7	7·7	**20·2**
9″ and under 10″	25·4	26·3	26·4	23·0	20·2	22·0	**33·5**

As a result of this appearance of a much greater number of smaller lobsters in the measured samples the relative percentage of lobsters of eleven inches and over (22 per cent. as compared with 36·5 per cent. and 37·5 per cent. in 1936 and 1935 respectively) is unduly depressed. In the absence of evidence that, in the case of lobster stocks there occur fluctuations of such magnitude as to preclude associating the

general trend of change in the size composition with fishing intensity, it had been considered that, provided sampling were representative, measurement data would supply a pointer as to the effect of the fishery on the stock. The indication obtained this year at Burnmouth that there may be considerable long period fluctuation in recruitment emphasises the need for more detailed data regarding the catch effort expended in lobster fisheries generally. The possibility of obtaining these is again being explored by the issue of more detailed instructions and by a suggested increase in the number of observation stations.

In the Rousay district where a voluntary landing size limit of 9 inches is observed, there is no evidence of abnormal stock recruitment, the relative percentages of the 9 to 10 inch group for the successive years 1931 to 1937 being 7·5, 10·6, 13·4, 19·4, 16·6, 15·1 and 14·8 unless the figure for 1934, 19·4, can be so interpreted. The corresponding figures for the larger lobsters landed (11 inches and over) are 73·2, 71·0, 65·7, 56·1, 59·1, 60·6 and 60·6 and in the case of this district the conclusion may be justified that over a number of years stock conditions have remained fairly static.

Plaice.

Monthly measurements of the size categories of plaice from the commercial seine-net catches in Aberdeen Bay were carried out during the year.

Statistics of the plaice landings by commercial seine-net vessels at Aberdeen market were carried out during the nine months, March to November 1937. The plaice were caught mostly in Aberdeen Bay, 5 per cent. only coming from the adjacent Nigg Bay. These latter catches had no appreciable effect on the general landings, though the fish consisted largely of

Aberdeen Market Statistics 1937.
Commercial Seine Net.

Month	Percentage Catches of Various Categories			Total Landings (Boxes)	Number of Arrivals	Average per Arrival (Boxes)	Number of Large Fish
	Medium	Small	Ex. Small				
March	46	32	22	295	98	3·0	
April	39	32	29	387	174	2·2	+123
May	43	30	27	238	144	1·6	+ 88
June	51	22	27	104	115	·9	+ 36
July	9	21	70	539	130	4·1	+ 3
Aug.	7	29	64	1179	196	6·0	+ 14
Sept.	10	33	57	1820	335	5·4	+ 3
Oct.	20	37	43	581	182	3·2	+ 9
Nov.	37	37	26	97	97	1·0	+ 2
	17·5	30·7	51·8	5240	1471	3·6	278

the medium category. The total landings amounted to 5,240 boxes for 1471 arrivals, an average of $3^1/_2$ boxes per arrival, which is practically identical with the landing figure for the previous year (1936) over the period June to November. The "medium" category accounted for 915 boxes, "smalls" 1608 boxes and "extra smalls" 2717 boxes, or 17·5, 30·7 and 51·8 per cent. respectively. In addition, 278 large fish were landed as odd lots in the course of the year, principally during the period April to June, when 247 of these large sizes were captured.

Representative samples of each of the three trade categories (medium, small and extra small) were measured each month. The size range and the range in monthly means for each of the categories were as follows.

Category	Full Size Range	Range in Monthly Means
Medium.....	27—42 cm.	30·2—33·5 cm.
Small.....	25—33 -	26·8—28·5 -
Extra Small.....	22—28 -	23·9—26·2 -

The total measurements, 9 boxes of each category, on being raised to the total landings for each category, indicate that just over 50 per cent. of the landings consisted of plaice of 25cm. and under in size. The percentages at and below 25, 30 and 35cm. were 53·1, 93·7 and 99·7. The numbers less than 25cm. (10 inches) in length, reckoned on the above basis, amounted to 37 per cent. of the total landings. The age composition of the landings has been estimated from the catches by the research vessels "Explorer" in September 1936 and "Kathleen" in July and September 1937. The landings in March, April and May consisted largely of group III (1934 year-class) with some fish belonging to group IV (1933 year-class) and some of the faster growers of group II (year-class 1935). The table shows a rapid decline in the landings during May and June which is most probably due to reduction in numbers of group III and the partial fishing out of the older group IV without corresponding replacement during these months in numbers of marketable sizes by the upgrowth of the younger group II. The trawling by the "Kathleen" in July and September showed the marketable stock to be composed largely of group II, 28·5 per cent. of this group being of marketable size in July and 72 percent. in September. The commercial catches, therefore, during this period (July to September) were composed largely of this brood (1935) but some of the 1934 brood were still present on the grounds, as well as a few older fish (1933 year-class), while a few of the fastest growers of group I (1936 year-class) were beginning to appear in September.

The figures show quite plainly (1) that intensity of fishing on the stock in an inshore area which is open to seine-net fishing, results in rapid diminution of the marketable sizes before the offshore spawning migration takes place, and (2) that even with intensity of fishing, the natural replenishment of the stock is still being maintained. The same trend of events has been shown in this area (Aberdeen Bay), which is an area of good growth rate, during two consecutive years (1936 and 1937) when the stock had been

replenished by three successive years of good survival of the youngest age-groups, i. e., broods hatched in 1933, 1934 and 1935. Since 1935, however, there have been in Aberdeen Bay two consecutive years (1936 and 1937) of relatively poor recruitment, so that considerable changes are to be expected there during 1938. The year-class 1933 will, for all practical purposes, be fished out or the few surviving representatives will have emigrated for spawning purposes. The 1934 brood will be depleted to negligible quantities so that the marketable stock will depend on the survival of the originally prolific 1935 brood, the weaker 1936 brood and on the upgrowth later in the year of the 1937 brood. Continuance of the observations during 1938, therefore, are essential for a comparative study of the effect of fishing on the changes in the composition of the stock. It will be interesting to see how the upgrowth of the immature stock keeps pace with the intensity of fishing.

(b) Fishing Technique.

Scotland.

Echo Sounding for the Spotting of Fish Shoals.

The Board's research trawler "Explorer" is fitted out with the latest echo-sounding device which has been used repeatedly for the spotting of fish shoals, especially herring. So far, the results have been negative, even on grounds during the spawning concentrations, where the "feeling" wire has given positive evidence of the presence of fish. It is difficult to give a satisfactory explanation, especially as the same type of machine has been successful in deeper waters off the Norwegian coast, but the following points suggest themselves, namely, the relative shallowness of the water off the Scottish coast and the more scattered nature of the herring shoals.

V. FISH

(a) Herring.

France.

Observations on the Fladen Ground herring were continued on the same lines as in recent years.

Germany.

179 samples of herring, involving a total of 29,188 fish, were examined during the year. 41 of these samples, comprising 4700 herring, were from market landings. The remaining samples were from catches obtained at sea and worked on board. The herring were examined as to length, sex, stage of maturity, age and numbers of vertebrae and keeled scales (K_2). The object of the investigations was to establish the different components and to ascertain the proportion of their abundance in the catches. Special attention was directed to the examination of the otoliths which exhibit features in their structure which in all probability afford a better distinguishing character, especially as it can be applied to the individual fish. These investigations are not yet completed and further details will be furnished later.

Scotland.

The programme of herring investigations was extended in 1937 to include a survey of the herring population of the Scottish west coast, more particularly in the neighbourhood of Barra Head and Stornoway and the adjacent waters in the region of the Isle of Man and off the north-east coast of Ireland.

Firth of Clyde.

The Clyde fishery was unsuccessful during the spring spawning season, as had been anticipated in last year's report and the landings throughout the year were of poor quality, small fish predominating in the catches. The scarcity of large herring in the Clyde estuary, the responsibility for which has been attributed to extensive ring-net fishing, has been a matter of some concern in recent years. The "Clyde" herring are not permanent inhabitants of the estuary, for they leave whenever they become adult and have spawned. The conditions in the Clyde fishery are applicable to the entire Scottish west coast where the stock of large adult fish has been small for a number of years. Some prospect of improvement is foreshadowed by the abundance both in the Clyde and along the entire west coast from Barra Head to Stornoway of a numerous brood of herring produced in the spring of 1935. Many of this new brood have already reached a size within the range of capture by the nets employed, and while a considerable improvement in landings is almost certain to result in 1938, the new recruits cannot be expected to reach adult size before 1939 or 1940, so that quality in respect of size is likely to be below the normal west coast standards.

Firth of Forth.

The landings during the spring fishery in the Firth of Forth, although well above average, were considerably below expectations. This unfortunate result was due mainly to lengthy storm periods, when strong easterly winds were prevalent which probably seriously disturbed the inshore spawning grounds and certainly severely handicapped fishing operations. It is anticipated that four- and five-year-old fish of good quality as regards size will be prominent in the catches in 1938, and although the addition to the stock of three-year-old spawners is unknown the prospects are not so good as for the two previous years.

East Coast of Scotland.

The summer and autumn herring fishery on the east coast presented some unusual features for, while good landings were made in June and part of July at Lerwick, Fraserburgh and Peterhead, the landings at the intermediate ports of Wick and Stronsay during the same period were very poor. From about mid-July until the end of the season the drift-net fishery was a failure. On the other hand, the trawl

fishery for herring on the Fladen Ground in August, September and October was successful.

Analysis of the shoals on the drift-net grounds revealed that the herring population in the North-Western North Sea in June and July was composed mainly of spring-spawning and Southern North Sea late autumn-spawning herring. Adult Scottish autumn spawners, which are normally present on the Shetland fishing grounds in June and July, formed only a very small fraction of the samples examined during that period. With the withdrawal of the non-spawning components from the drift-net grounds in July the drift-net fishery collapsed, while the trawl fishery on the Fladen Ground entered a period of heavy landings. The relationship between the herring of the drift-net grounds and those of the trawling grounds in the region of the Fladen are discussed in some detail in a publication issued during 1937, entitled "Movements of Herring in the Northern North Sea" (*vide* Wood, H., Section VIII.)

The movements of spring spawners, as far as they are discussed in that publication, were confirmed by the material examined during 1937. A large number of the fish examined showed from the pattern of winter rings on the scales a considerably greater growth increment in 1936 than in 1935. This unusual feature on the scales was confined mainly to herring which were still immature in May, June and July, and race analysis revealed that they were almost exclusively spring-spawning fish. They were first recorded in the neighbourhood of the Patch and the Viking Bank in April and May. They were numerous within a distance of 50 miles from Shetland in May and June but had disappeared from these grounds by the third week in July. They were conspicuous in catches obtained on the grounds off Fraserburgh and Peterhead in June and July, increasing in their proportions in the samples examined as the season advanced, but were quite absent from a sample obtained on these grounds on 12th August. They were rarely encountered in samples obtained off the Berwick coast but, on the other hand, they were very prominent in all samples obtained from the Fladen Ground from August to October. By this time some began to show development of the gonads and it is hoped by sampling spawning shoals in February and March to locate the spawning grounds of this group and thus add to our knowledge of its movements.

Spring spawners on the drift-net grounds were strongest in fish in their third, fourth and fifth years. Southern North Sea late autumn spawners were characterised by a predominance of fish in their fifth year, while the only outstanding group in the Scottish autumn-spawning population was nine years old. The Scottish autumn-spawning stock is meantime much below average strength and unless the 1935 brood is considerably more successful than the broods which had emerged between 1929 and 1934, the prospects for the Scottish summer drift-net fishery in 1938 after mid-July are not reassuring.

West Coast.

The herring on the west of Scotland during 1937 were predominantly spring spawning. An appreciable number of autumn spawners was present on the Minch grounds, but the proportions in the region of Barra Head and the Stanton Bank were almost negligible. On the other hand the maturing herring shoals sampled in the neighbourhood of the Isle of Man, Ardglass and North Ireland in August and September consisted mainly of young fish three and four years old, which showed the race characters of an autumn-spawning stock. The immature stock was composite and included both spring and autumn spawners. This would appear to be the source from which had originated the shoals of one-year-old autumn-spawning herring which appeared in the Clyde estuary during the last quarter of 1936.

Samples of very large herring were obtained from catches by trawl made off the north and north-west coasts of Shetland in February and March, near the Flannan Islands in March, and from catches by drift-net made in the neighbourhood of Limeburner Buoy off the north coast of Ireland in April. All these samples showed very similar race characters and belonged obviously to the same spawning stock or race. Considerable differences were apparent in age and size. The average size of the North Ireland herring was 32·5cm. ($12^3/_4$ inches) and nearly 50 per cent. of the fish examined were six years old. The Shetland herring, on the other hand, had an average size of 34·5cm. ($13^1/_2$ + inches) and the most numerous year-class was twelve years old. These large spawning herring do not occur in the North Sea. Their habitat is obviously in the deeper oceanic waters and they only come near to the banks and coastal areas to spawn in February and March. The majority of the spring spawners found in the Northern North Sea are invariably young fish, frequently immature. In their race characters they are very similar to the older large herring which spawn in the region of the continental slope. The spawning grounds on the edge of the continental shelf would appear to be extensive but much of the ground is rocky and the location of spawning grounds based on records of the capture of fish which have been feeding on herring spawn is limited to the relatively small area where trawl fishing is possible. Important spawnings have already been located on the slope or on the edge of the slope of the north and north-west coasts of Shetland and in the neighbourhood of the Flannan Islands. During April 1935 great numbers of larval herring were caught north of St. Kilda by means of tow nets which indicates from the known water movements in this region the location of an important spawning ground in the neighbourhood of the St. Kilda group of islands.

Location of Herring Spawning Grounds.

The skippers of commercial trawlers landing at Aberdeen and Granton continued the returns of "spawny" haddocks and thus rendered valuable

assistance to the investigations in determining the actual positions of the spawning grounds. The records from Scottish waters during the year occurred at two distinct periods (1) in the spring months from the last week in February to the first week in April and (2) in the autumn from the third week in August to the third week in September. Out of eighty odd returns in the spring months three-quarters were obtained during the first half of March. All the records were secured in the area west and north-west of the Shetlands at depths ranging from 60 to 80 fathoms. This is a favourite trawling ground during the early part of the year for vessels working from Aberdeen and this may explain the high number of returns. The same feature occurs year after year in this area so that a considerable concentration of spring spawning herring must take place on the plateau between the Atlantic Slope and the Shetlands from February onwards. "Spawny" haddocks were also taken by the research vessel in the neighbourhood of St. Kilda in April.

The autumn records were obtained chiefly from depths of 30 to 50 fathoms off the north-east corner of Aberdeenshire during the last week in August and the first three weeks in September. A few records were also got from the vicinity of the Longstone at the end of August and in September.

(b) Haddock.

Scotland.

The Effect of Stock Recruitment upon Recent Commercial Results.

One of the most important results of recent research upon the haddock has been the demonstration that the landings of "small" fish from the North Sea rise and fall from year to year in step with the degree of success or failure of the broods of two years earlier. The accompanying diagram (see page 39) shows the graph of the relative values of the North Sea year-classes hatched from 1922 to 1932, as assessed from research data, together with the total landings of "small" haddock at all British ports from 1924 to 1934, as subsequently compiled from statistics of the commercial landings. There can be no doubt whatever as to their intimate agreement.

Following upon 1934 the landings of small haddock from the North Sea continued to fall. In 1935 and 1936 they amounted to 794,225 and 641,919 cwts. respectively, as against the 1934 figures of 996,468 cwts. These values completely confirm the unsuccessful nature of the three consecutive broods 1932, 1933 and 1934, warnings of the failure of which, evident from research data from their first years of life, have been duly given in previous reports.

Actually, the brood of 1933 was numerically stronger than that of 1932. The former showed a relative value of 2·6 in research data in the first year of life as against only 1·2 in the case of the latter. The slight rise was not sufficient to avert a further fall in subsequent landings. The first year relative value of the brood of 1934 was as low as 0·9. It was the poorest year-class for some twelve years. In the month of June 1936, the lowest monthly landings in fourteen years occurred.

As early as October 1935, however, it was possible to say that the brood hatched some six months earlier promised to be the most successful probably since 1928. In the annual report which followed it was stated that this brood was both numerically strong and widely represented throughout the North Sea area, and that it would bring about a decided improvement in commercial catches in due course. By the close of 1936 the entry of the 1935 brood into commercial landings had already begun, the monthly landings of small fish rising from 22,863 cwts. in June to 90,608 cwts. by November of that year. While the total figure for the whole year is not yet available, the monthly returns already to hand show that the improvement was fully maintained in 1937.

In these statistics of landings, covering the whole of the fishing ports of the British Isles, catches are divided into the two categories "large" and "small". At Aberdeen, however, the landings are grouped in the five categories "extra small", "small", "medium", "large", and "extra large". They demonstrate the trend of the catches in more detailed form.

The following are the total amounts of these different categories landed at Aberdeen in recent years:—

	Extra Large	Large	Medium	Small	Ex. Small	Total
1934	9,319	25,927	40,291	67,686	398,510	541,733
1935	11,781	29,227	46,137	76,646	372,627	536,418
1936	14,900	31,597	41,721	61,841	282,721	432,780
1937	14,856	23,249	31,530	58,583	452,698	580,916

The "extra small" category averaged 72 per cent. of the total over the years in question and was the mainstay of the market. In common with the landings of "small" fish at all British ports, it reached a particularly low level in 1936, but rose abruptly in 1937, due to the influx of the strong 1935 brood. It is also seen from these figures that the prediction in last year's report, to the effect that the decline felt in 1936 in the smaller categories would become increasingly evident in the larger selections, was duly fulfilled.

The Present State of the North Sea Stock and the Commercial Prospects of the Area.

In the course of the past year, over 35,000 scale age determinations of North Sea haddock, taken by the research ship "Explorer", were made. These, as in the past, have been supplemented by scale material from commercial catches and from the research operations of other European countries, and also by data obtained by the new motor research vessel "Kathleen". Valuations of the numerical strengths of the different year-classes in the area, and details of their respective centres of greatest density, have again been arrived at.

The deductions as to the general state of the stock from previous years' investigations, were fully confirmed in 1937. Of fish older than the 1935 brood, that is the survivors of the 1934, 1933, 1932, and earlier year-classes, only small numbers were found. Altogether they made up only 5 per cent. of the "Explorer" catches. The 1931 brood, in its seventh year of life, was more numerous than either that of 1932 or 1933, and was only slightly less so than the 1934 brood, still in its fourth year. Once again the degree of failure of the three consecutive year-classes 1932, 1933, and 1934 was well illustrated. The 1931 class, originally of decidedly more than average numerical strength, is now so depleted as to be of no commercial significance. Isolated survivors of the five broods born from 1926 to 1930 were also met with. These year-classes are now to be regarded as almost wholly fished out.

It has now long been known that the year-classes of the Scottish area tend to be distributed in their initial years mainly in water of moderate depth within the North Sea, while with increasing age they tend to segregate more and more to the deeper water to the north, north-west, and west of the region. The initial distribution of the 1931 brood was chiefly in the north-west North Sea from Muckle Flugga to the Northumbrian coast. The brood of 1932 was originally located mainly in the northern reaches of the North Sea. The main initial concentration of the 1933 year-class was in the central and eastern North Sea, as the 1934 brood was likewise in greatest density in the central waters of the area.

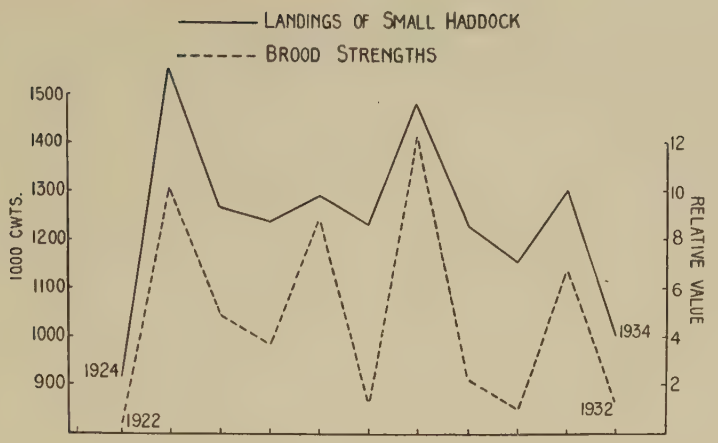
Now, however, all these year-classes are to be found in greatest number to the north, north-west, and west of the North Sea proper. While all year-classes older than that of 1935 together made up only 5 per cent. of the total "Explorer" catches for the year, out of approximately 7,000 haddock taken at various times on grounds to the north-west and west of Scotland they made up as much as nearly 10 per cent. According to research data, the initial frequency of the 1935 brood in relation to its predecessors corresponded to a value of 7·3. In its second year it yielded catches of approximately 2,200 fish per 10 hours' fishing, and formed about 90 per cent. of the haddock stock of the region. In 1937, its third year of life, it formed approximately 74 per cent. of the total "Explorer" hauls, corresponding to an average of about 1,000 per 10 hours' fishing. It has been figuring in commercial catches since the autumn of 1936, and is already showing signs of depletion. Nevertheless it can still be said to be strongly and widely represented in the North Sea and contiguous waters. In its initial distribution, as stated in previous reports, it showed far more than average strength in the north, north-west, and west, and in 1937 it supported unusual landings of large fish from the Minch and adjoining grounds, along with such survivors as there were of the older year-classes of the stock. The average size of the 1935 brood in the north-west and west was as high as 12—13 inches by the month of August, and the largest individuals taken by the "Explorer" were as much as 16—18 inches in length. The stock of the species in these waters over the period in review, due in by far the greatest proportion to the 1935 brood, was the best for quite a number of years.

It was stated in the report for the year 1936, that the Moray Firth, which is not in itself a spawning ground of the haddock but depends upon replenishment from the body of the North Sea, became heavily populated by an influx of the brood of 1935 from the spring of 1936 onwards. At the close of 1936 the region contained the largest stock of haddock it had had for some considerable time. The immediate prospects of the line and seine net boats of the area were thus particularly bright. While that anticipation was in a measure realised in 1937, the latest surveys of the region indicate that the 1935 brood has now taken off again. In a total of five hours' trawling by the "Explorer" in the Moray Firth in November 1936, for example, 1,402 specimens of the 1935 class were taken. In a total of 29 hours' trawling with the same gear over the same grounds in October—November 1937, only 381 specimens of the 1935 brood were secured. So far, no obvious explanation suggests itself, but the stock has not vacated the region, excellent hauls of the year-class being made in the deeper water to the north-east of the Moray Firth.

Experience in the past has shown that even a prolific brood has made its greatest contribution to commercial landings by the end of its third year of life, and that it ceases to be of major importance in supporting commercial operations by the end of its fourth. In that is summarised the immediate outlook with reference to the brood of 1935. Before the close of 1938, it will have passed through the "extra small" and "small" categories. These normally provide about 85 per cent. of the landings from the North Sea. Its effect will still be felt upon the larger trade selections, but its numbers, in 1939, will undoubtedly be vastly reduced. Maintenance of the catches of small fish in the future will thus depend upon the new broods now in the area.

By the close of 1936 it was already obvious that the brood born in the spring of that year was decidedly less successful than its predecessors. Special study was therefore given in the past year to ascertain its distribution and relative value. It now appears to be best represented in the Central North Sea with concentrations off the east of the Shetlands and off the north-east of the mainland of Scotland. This is the region of slowest growth within the North Sea. Over the year as a whole it formed about 20 per cent. of the "Explorer" catches. The average catch was about 240 per 10 hours' fishing, that is, about one-tenth of the strength of the 1935 brood at the same stage. There can now be no doubt as to the unsuccessful nature of the brood in question. It cannot possibly maintain the improvement in catches brought about by the brood of 1935.

Unfortunately the brood born in 1937 also appears



to be of inferior order. It is too early a stage in the life history of this latest year-class for a definite pronouncement as to its main locations and its general numerical value. It is, however, in its first year, of similar occurrence to the 1936 brood. It is certainly not of such strength as would lead one to expect from it any appreciable increase in catches in subsequent years.

The immediate outlook is thus a continuance of the improvement brought about by the 1935 brood. Its influence will now be felt more upon the larger trade selections. Following upon that, the recruitment of the smaller selections will not be sufficient to maintain the present level of landings. So far, the situation does not promise to be so acute as it was as a result of the three unsuccessful broods 1932, 1933, and 1934, when, in 1936, landings fell to particularly low levels. The trade will nevertheless have to be prepared for another temporary spell of poorer North Sea catches.

Previously, three years of brood failure have been observed consecutively only once. Year-classes of greater than average numerical strength have occurred mostly separated by two less successful seasons. There is every reason to expect further strong recruitment of the area in due course. Such is the intensity of modern fishing operations, however, that even a prolific brood like that of 1935 forms the mainstay of the fishery for only a relatively short period so that the depressed fishery conditions in the intervals between the prolific year broods become all the more accentuated.

Iceland and Faroe.

In May 1937, the "Explorer" surveyed the grounds around the Faroe Islands. A similar cruise was executed in May—June 1936, from which it was ascertained that the 1935 year-class had met with success there as well as in the North Sea. The 1937 hauls confirmed this observation but the poor representation of 1936 fish in them suggested that the latter brood is not of like numerical proportions.

Efforts are continuing to be made to improve upon the collection of research and commercial data both from Iceland and Faroe with a view to compiling brood strength assessments and yield predictions for these independent regions comparable with those of the North Sea.

(c) Plaice.

Scotland.

Inshore Investigations.

Frequencies and Age Composition on the Various Sections of the Scottish Coast.

The total actual numbers of plaice caught by the motor research vessel "Kathleen" from July to November 1937 within the territorial limits throughout the east and north coasts of Scotland during seventy-four hours' trawling amounted to 7698, or an average of 104 fish per unit haul of one hour's duration. Otolith age determinations were carried out on all these fish. The present condition of the plaice stock, therefore, may be gauged from the following figures which represent the frequencies per 1000 fish at the various age-groups.

Age-Group ..	0	I	II	III	IV	V	VI and over
Year-Class ..	1937	1936	1935	1934	1933	1932	1931 and older
Frequencies per 1000..	63	230	534	140	30	2	1

The brood of 1935 predominated in the catches in the areas south of the Moray Firth, but was relatively equalled in the Moray Firth and north of Scotland catches by the younger brood of 1936. There were no comparable observations on the 1935 brood as group I in 1936, but the high representation as group II in 1937, after considerable attrition in areas open to seine net operations, confirms the previous estimate as to the good survival of this year-class. The percentage age composition on the various sectors of the coast was as follows:—

Age-Group ..	0	I	II	III	IV	V	VI+
Year-Class ..	1937	1936	1935	1934	1933	1932	1931 and older
North Coast	6·7	42·5	43·1	4·5	2·2	0·3	0·7
Moray Firth	8·7	36·9	37·6	13·2	3·5	+	—
Aberdeen Bay	16·4	10·2	71·9	1·2	0·3	—	—
Carnoustie a. St.Andrews	3·8	10·0	81·1	4·4	0·7	—	—
Firth of Forth.....	11·1	20·4	53·8	12·4	2·0	0·2	0·1
Berwick Coast.....	2·7	8·2	43·8	37·5	6·7	0·7	0·5

The trawl is not an efficient apparatus for the capture of 0-group plaice, largely because of the small size of the fish and their shallow water distribution. The figures, however, may be taken generally from the point of view of the strength of the new accession to the stock by the brood of the year (1937) in the important nursery areas of St. Andrews Bay and Dornoch Firth. Had recruitment been on a liberal scale, much larger numbers would have been obtained at these localities, especially at the end of the year when the operations were carried out. It is reasonably safe, therefore, to assert that 1937 has been a poor recruitment year so far as plaice are concerned on the north and east coasts of Scotland. As indicated elsewhere, the older brood of 1936 was weakly represented especially south of the Moray Firth and was only of moderate strength in the Moray Firth and along the north coast of Scotland. The territorial sectors of the coast closed to commercial operations are the north coast, the Moray Firth, the northern half of the Firth of Forth, and the Berwick coast. In all these sectors there is, as to be expected, and as indicated in the above table, a higher percentage of larger fish. The minimum landing size from intra-territorial waters is 25cm. (10 inches) and the proportion of marketable sizes in the research vessel's catches shows the trend of events.

	Percentage Numbers at 25 cm. and above
North Coast.....	14
Moray Firth	24
Aberdeen Bay.....	17
Carnoustie and St. Andrews.....	5
Firth of Forth	21
Berwick Coast.....	49

The average size of the marketable stock in those inshore areas, a stock which can only be renewed by the upgrowth of smaller fish, is dependent on the growth-rate of the species and the intensity of fishing.

Plaice Transplantation Experiments.

Experiments were begun in the autumn of 1935 in collaboration with the Ministry of Agriculture and Fisheries, the object being to study the behaviour of fish maturing to spawn during the winter immediately following their transplantation. The data are accumulating and may lead to interesting results, but difficulty has been experienced in getting a sufficient number of fish at the right stage of development. During the recent experiment this difficulty was largely overcome and the recoveries so far obtained give promise of interesting results. On 5th October 1937, a total of 637 plaice, which had been captured by the Board's research vessels in Largo Bay, Firth of Forth, were marked and liberated from the "Explorer" about $3\frac{1}{2}$ miles north from Haisboro' Lightvessel at the position 52°59′ N. 1°29′ E. These consisted of 325 males and 312 females, ranging in size from 24 to 52cm.; 83 per cent. of the males were 28cm. and over in length, while 80 per cent. of the females measured 33cm. and above, so that the transplanted fish were mostly of mature size.

The recaptures at the end of the December amounted to 52 fish. Most of these were taken 30 miles from the liberation point, but a decided scattering northwards, eastwards and south-eastwards was evident. A few of the fish had already travelled relatively long distances. Four were recovered north-east of the Spurn after periods ranging from 43 to 69 days' freedom. Three fish were recaptured in shallow inshore waters off Lowestoft, Southwold, and on Dunwich Bank, the last two after only 11 days' freedom. Of the three remaining migrants so far recovered, two were males, in one of which the reproductive organs were well developed, while the female was at stage V in the maturity scale. These had been at liberty from 42 to 72 days and were recaptured 18 miles NE. of Smith's Knoll, 27 miles SSE. of Lowestoft and 18 miles SE. by S. of Smith's Knoll. Since the beginning of 1938, most of the recaptured, including fish ready to spawn or recently spent, have been effected off the Yorkshire coast. The migrations of fish for spawning purposes are, generally speaking, against the prevailing currents and these particular observations confirm the normal southerly movement of the water masses in this area.

(d) Lemon Soles.

Scotland.

During an intensive study of the age analysis and growth of lemon soles in Scottish waters the existence of different growth-rates varying from the good growth-rate of the Western Central North Sea to the poor growth of North Shetland and parts of the north-west and west coast regions was clearly evident. With a view to trying to explain these differences, investigations were commenced on the food of lemon soles. Samples of stomachs were accordingly collected by the research vessels and from commercial trawlers throughout the year.

In addition to acquiring knowledge of the types of food eaten by lemon soles, some interesting information has been gathered regarding the intensity of feeding of the species in different months. Although

ecords are not quite representative over a complete ear, it is clear that feeding increases in intensity uring the spring, reaches a maximum in May, June nd July, and declines gradually until November. owards the end of this month a sudden and almost omplete cessation of feeding occurs which is continued hroughout December. Out of a total of 162 stomachs xamined in this month, 157 or 97 per cent. were mpty. Furthermore 94 per cent. of the intestines ontained no food, thus indicating that the stoppage f feeding is of considerable extent and duration.

The food of lemon soles is composed chiefly of five ifferent types — polychaetes, crustacea, molluscs, chinoderms and coelenterates. Of much less impor- ance, yet frequently represented in the stomachs, re nemertean and gephyrean worms, while fish, olyzoa, ascidians, tubellaria and red algae occur uch more rarely. Of the five principal types poly- haetes constitute the most important group in each f the different growth zones. Generally speaking, rustacea and mollusca come next in importance — rustacea being more frequently eaten in northern rounds, particularly off the north-west coast. Echino- erms, though less important, nevertheless play a onsiderable part in the diet in Shetland waters. oelenterates (chiefly represented by the Anthozoan *'crianthus*), form a big food item on southern grounds, e., south of Rattray and in the southern Moray Firth.

A total of 1313 lemon soles was caught by the Explorer" during 1937. The following is the age nalysis of the fish as determined by scale readings:—

ear-lass	No. of Fish	%	Year-Class	No. of Fish	%
936.....	2	0·2	1928.....	48	3·6
935.....	72	5·5	1927.....	21	1·6
934.....	200	15·2	1926.....	23	1·7
933.....	449	34·2	1925.....	3	0·2
932.....	147	11·2	1924.....	5	0·4
931.....	123	9·4	1923.....	—	—
930.....	177	13·5	1922.....	—	—
929.....	42	3·2	1921.....	1	0·1
			Total...	1313	Fish

hese include fourteen broods ranging from 2 to 17 ears of age. Of these the 1933 brood is by far the rongest, forming over 34 per cent. of the total. This rood may be classed as a very good brood on a vel with those of 1930, 1926, 1922 and 1921. In the 936 report it was pointed out that the 1933 brood as strongly represented on southern grounds, parti- ularly in the Moray Firth. It can now be said that s distribution is not uniform and that on East rkney, Fair Isle, N.W. coast and west coast grounds is only of medium strength. Round Shetland it is ven poorer and cannot be compared with the strength f the 1930 brood in these waters at the corresponding eriod of its life. It is expected, however, that during ie next two or three years, percentages of the 1933 rood in northern waters will improve slightly owing the growth of the smaller individuals which hitherto have escaped the trawl and to immigration from southerly grounds.

In a half-yearly survey of the 1937 catch (September 1937) the percentage of the 1933 brood was given as 30·9. It was expected that the percentage would remain about 30 up to the end of the year and throughout 1938 if its fortunes followed those of former good broods. So far this has proved reasonably accurate. Owing to the intense activity in seine net fishing in the Moray Firth, however, this brood is being subjected to greater attrition so that it will be interesting to note its survival in this region.

For some years the 1930 brood has been the mainstay of the lemon sole fishery. Now in its eighth year, it has suffered severe diminution in numbers, and in September the percentage of 18·5 for the first half of the year was expected to fall by the end of the year. The figure of 13·5 per cent. for the whole year shows a rapid fall in the numbers of 1930 lemon soles during the latter half of 1937. This may be somewhat exaggerated owing to the fact that operations of the research vessel during the latter half of the year were more confined to the Moray Firth and other home waters, where the supply of 1930 fish is naturally smaller than on more distant grounds, which are less intensively fished and to which migrants from home waters proceed. The fact remains, however, that the good 1930 brood cannot be expected to sustain the lemon sole landings. This burden must now fall chiefly on the 1933 brood.

The 1931 and 1932 broods, as the percentages show, are both weaker than the 1930 brood and are also on the decline. In comparison with other post-war broods, these two are only of moderate strength. The 1932 brood numerically is a trifle stronger than that of 1931, but this is offset commercially by the fact that the latter has a southerly distribution with a better growth rate than the former, the distribution of which was more northerly. Although it is too early to forecast the 1934 brood strength, there are indications that it is rather better than either 1931 or 1932 although it does not seem to reach the standard of 1933.

(e) Mackerel.

France.

Observations on the mackerel fisheries and on the concentrations of mackerel on the Fladen and Utsire Grounds were continued. The numerous measurements show that there are no marked differences in the morphological characters (morphological indices) between the mackerel of the Atlantic and those of the North Sea. The observed indices are extremely near and the vertebral mean is exactly the same.

Sweden.

Co-operation was effected with two Swedish fishing vessels in the search for mackerel. The Danish seine was utilised on Unst Bank and just south of this region and fairly good catches were obtained. Attempts to catch the mackerel by hooks were not successful.

(f) Ling.

Sweden.

The main object of the cruise of the "Skagerak" in July—August to the Northern North Sea was a study of the ling. The investigations were somewhat curtailed by force of circumstances, but a certain amount of useful material was collected, chiefly concerning the composition of the stock and the growth conditions. The material was secured by lines in the region to the north and north-west of the Shetlands.

VI. SHELLFISH

(a) Lobsters.

Scotland.

Comment was made in last year's report regarding the unsatisfactory circulation and water conditions at the Bay of Nigg station under which the stock of lobsters maintained for casting and growth-rate observations was living. Further deterioration of these conditions having developed in the early part of 1937, it was arranged for this observational work to be continued at the Laboratory of the Scottish Marine Biological Association at Millport. Accordingly all the smaller lobsters, along with those of the larger ones whose histories indicated that further useful comparative data might be forthcoming, were transferred to Millport.

Two of the males were mated with females from the Clyde, considerably larger than themselves, as well as with smaller females from Aberdeen. Altogether six matings were made and all were followed in four to six weeks' time by spawning. Unfortunately about two months later the females lost nearly all the eggs. There is as yet no indication as to the cause of this stripping.

The experiments have been in operation only for a relatively short period, when too many liberties could not to be taken with the limited material at disposal, but it is hoped to get results of value during the next twelve months.

VII. BOTTOM FAUNA

France.

The bottom deposits collected by the "Président Théodore Tissier" to the north of latitude 54° N. have been examined. The basic volcanic rocks occupy an important place among the old sediments. They appear much more numerous and extensive as the Northern North Sea is approached and one can only suppose that they come from Scandinavia or from Scotland. On the Fladen Ground, in the (supposed) course of the old valley of the Rhine, actual sedimentation takes place intensively in the form of mud, sand and shell fragments which gradually cover and raise the level of the older formations which consist of stony heaps of glacial origin and which assume in places, especially along the Norwegian Deep, the aspect of old moraines.

Scotland.

During the year the investigation on the food of plaice was extended to the north of Scotland and to grounds east of the Forth. An intensive survey of the bottom fauna of a section of the Firth of Forth was conducted during July, while the work on the distribution of prawns was also advanced.

The main food supply of adult plaice in the deep water off the north of Scotland consists chiefly of sandeels and the lamellibranch mollusc *Spisula elliptica*. Nearer the shore lugworm may be the chief food or the young plaice may feed typically on amphipod crustacea and the older fish on common worms and sandeels.

Sandeels likewise contribute extensively to the food east of the Forth, but razor shells (Solen) and heart urchins (Echinocardium) are also important on certain of these grounds. On the sandy ground west of Dunbar the extensive populations of the bivalves Donax and Tellina are strongly favoured by the plaice.

An extensive part of the Firth of Forth is divided into areas which are distinguished by the texture of the bottom, whether it consists of pure mud or mud mixed with sand. Each area sustains a typical bottom fauna. The typical animals within the former are the bivalve Syndosmya with which the polychaete worm Ammotrypane is associated; both are regular items of fish food.

Within the second area there is a much wider variety of food species, chiefly worms of which the tube form Melinna predominates. Dense patches of small crustacea (amphipods and crustaceans) are also located within the Firth, being associated principally with the areas of sand and mud.

There are four common species of prawns in Scottish waters. *Pandalus montagui* is the most widely distributed, being absent in numbers only in the deep central basin of the Northern North Sea. The densest populations are located off the Scottish East Coast Bight, off Noup Head in the Orkneys, in the vicinity of Foula, and in the Firth of Clyde.

Spawning occurs from November onwards, while all eggs have hatched by the following April. By December the young brood has attained an average length of 5cm., the respective size for the previous year's brood being 7cm. to 8cm.

P. leptorhynchus is found in the North-Western North Sea and off the west of Scotland. *P. propinquus* however, is confined to the latter area and principally to the Minch.

P. borealis is the largest prawn and attains a size of 5 inches. It is a source of commercial revenue in Iceland and Norway, but in Scottish waters is found in large numbers only on the Fladen Ground.

VIII. List of Papers issued during the Year on Work within the Area.

FRASER, J. H. The Distribution of Chaetognatha in Scottish Waters during 1936, with notes on the Scottish Indicator Species. (Journ. du Conseil, Vol. XII, No. 3, 1937).

Gibbons, S. G. Variations in Copepod Development. (Nature, Vol. 140, $^{18}/_{12}$ 37).
Gibbons, S. G. and J. H. Fraser. Experiments with the Hardy Plankton Indicator in Scottish Waters, I. (Journ. du Conseil, Vol. XII, No. 1, 1937).
— The Centrifugal Pump and Suction Hose as a Method of collecting Plankton Samples. (Journ. du Conseil, Vol. XII, No. 2, 1937).
— The Modern Centrifugal Pump as a Plankton Collector. (Nature, Vol. 139, $^{6}/_{3}$ 37).
Lovern, J. A. and H. Wood. Variations in the Chemical Composition of Herring. (J.M.B.A., Vol. XXII, Nov. 1937).
Raitt, D. S. The Benthic Amphipoda of the North-Western North Sea and Adjacent Waters. (Proc. Roy. Soc., Edinb., Vol. LVII, Part III, No. 18, 1937).
Raitt, D. S. On the Occurrence of Gammarus in Scottish Coastal and Inland Waters. (The Scottish Naturalist, Nov.-Dec. 1937).
— A Collection of Benthic Amphipoda from Icelandic Waters and its relation to similar material from the North Sea. (Proc. Linn. Soc., Lond., 1937—38, Part 2).
Ritchie, A. The Food and Feeding Habits of the Haddock (*Gadus aeglefinus*) in Scottish Waters. (Fisheries, Scotland, Sci. Invest., 1937, No. 2).
Tait, J. B. The Surface Water Drift in the Northern and Middle North Sea and in the Faroe—Shetland Channel, Part II, Section 3. (Fisheries, Scotland, Sci. Invest., 1937, No. 1).
Wood, H. Movements of Herring in the Northern North Sea. (Fisheries, Scotland, Sci. Invest., 1937, No. 3).

SOUTHERN NORTH SEA COMMITTEE

1937.

By

A. Bückmann.

ntroduction.
. Work at Sea.
. Fish.
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Papers published in 1937 relevant to the Work of the Committee.

INTRODUCTION

The Committee's investigations go steadily forward ccording to plan. Each fresh year's work is a step owards the completion of our knowledge of the life is ories of the populations of food fishes, of the x ernal environment conditioning their lives and of he relations between the yield and the effort of the shery. Of the year's achievements, should we wish o select one having a particularly noteworthy bearing n the common task, we might point to the elaboration f the results of the extensive plaice marking experi- ents undertaken by England, and now brought to close.

With the advancement of our knowledge we are gradually approaching one of the principal goals of our studies, namely, the ability to gauge the manner and degree of fishing by which the highest possible yield can be secured from the commercially valuable fish stocks. Today this no longer seems beyond our reach, and in the threatening position of the catch of demersal fish in the North Sea we must bend all our energies to the attainment of this goal. The accomplishment of a very considerable part of the preparatory work is due primarily to the close co-operation between the stations which share the research. We must therefore consider whether closer

co-operation would not enable more rapid progress to be made in other lines of study also. Such a line is presented, for example, by the investigations on the local abundance of the herring fishery and — what naturally follows — on the movements of the herring shoals. Hitherto these have been carried out by the countries interested working up the statistical data for their own fisheries. It is well known that a number of countries fish for herring at much the same seasons, on neighbouring, though not the same, grounds. The question obviously arises, whether one could not obtain a much more complete picture of the movements of the shoals by combining the observations from the several countries.

In the present report plankton and hydrographic investigations are dealt with only in so far as they stand in immediate relation to other work in our area. To avoid repetition, the reporting of the more general activities in these fields is left to the relevant committees. The Belgian work in the Southern North Sea is fully described in the Report of the Combined North Sea and Eastern Channel Committee, and accordingly only brief reference will be made to it here.

Once more we gratefully acknowledge the benefit our work has had from the valuable assistance of the owners, officers and crews of Fishery Protection vessels, fishing vessels and lightships.

A. WORK AT SEA

Denmark.

The research vessel "Dana" was not available for work in the North Sea, as was also the case last year. A motor-boat operated in the inshore waters off Esbjerg in June, September, and November. Current measurements and plankton hauls were begun at the "Horns Rev" lightship on December 1st, in accordance with the arrangements previously entered into for this work.

The "Biologen" worked with the 50-foot otter-trawl at 26 stations in the Horns Rev neighbourhood between 18th June and 22nd July. The main object was observation of the plaice stock.

Fishing operations were undertaken with the "Eeltog" in Nissum Broad on June 3rd at 3 stations, and on September 20th and 21st at 6 stations.

Hauls with the Johansen young-plaice trawl were made from a motor-boat in the coastal region between Hanstholm and Ringkøbing Fjord from 19th to 27th August.

England.

The "George Bligh" was in continuous commission throughout the year. Seventeen voyages were carried out in all. Two comprised trawling work, including testing of new gear and vitality experiments. Four were for plaice eggs, and the remainder dealt with plankton and hydrography.

The M.V. "Onaway" was also in full commission and carried out her usual programme on herring shoals, plankton and hydrography.

The work on fish eggs and larvae was continued on the "Varne", "Galloper" and "Sandettié" lightships, the latter through the co-operation of Professor LE GALL. Current measurements with drift indicators and vertical logs took place on the above vessels, the "Cromer Knoll" and the "Royal Sovereign". Surface drift-bottles were released each week from the "Smith's Knoll" lightship. Surface samples on steamship routes have continued. The continuous work on lightships and steamships and the work of the English measurers on commercial vessels has been made possible by the courtesy of Trinity House and the owners, masters and officers of the vessels concerned.

France.

Routine observations have continued according to the same programme as before, as follows:—

1. "Sandettié" lightship. Temperature observations and water samples at various depths. Current measurements and plankton hauls, in collaboration with the Fisheries Laboratory, Lowestoft.

2. Routes Dunkerque—Dover and Boulogne—Folkestone. Surface salinity and temperature observations from commercial vessels, in collaboration with the Fisheries Laboratory, Lowestoft.

Cruises were made with the Fishery Protection vessels "Ailette" and "Quentin Roosevelt" from the Naval Station of the Channel, the North Sea and Icelandic waters.

Regular observations have been made on the herring and mackerel fisheries in the southern part of the North Sea and Eastern Channel, together with temperature determinations, water samples (surface and bottom), and plankton hauls.

Germany.

A cruise with the M. S. "Makrele" of the "Biologische Anstalt" was undertaken in the German Bight from 1st to 19th March 1937, mainly for investigations on the fry of fish and on plankton. Hydrographic observations were also made. The "Makrele" again operated in the German Bight from the 7th to 26th May. This cruise, devoted principally to the study of the population of food fish, the plaice and sole in particular, was arranged according to the same plan as the cruises of the "Poseidon" in the years 1929—1933. In addition, observations were made on hydrography, plankton and fry, with special reference to the spawning of the sole.

From the 22nd to the 25th May the "Poseidon" and "Makrele" were employed on comparative tests of the fishing capacities of the trawls used in the two vessels, to enable the new investigations to be compared with the old. The opportunity was taken for grab work also.

In July the "Makrele" undertook investigations of the fish stock in the neighbourhood of Helgoland. During the "Makrele"'s cruise in March daily hauls of fish larvae were made onboard "Borkum Riff" lightship.

olland.

From the 4th to 8th May the "Nautilus" carried
it investigations on the food fishes, in particular the
laice, on four lines off the coast of Holland.
In October and November observations of surface
mperature and salinity were made in the region
ing between the lines Hook of Holland—Lowestoft
id Calais—Dover.

cotland.

The "Explorer" operated within the area during
ort periods in July, September and October. All
e cruises were of a comprehensive nature and were
vised chiefly to extend the observations in the
rthern and middle North Sea grounds. Hydro-
aphic, planktonic and trawling operations were
rried out at all stations.
In July eleven stations were occupied between the
ut, Great Fisher Bank, Dogger Bank and the
orthumbrian coast. During September, six stations
pproximately 25 miles apart were worked from
aster eastwards to longitude 2°30′ East. In October,
pproximately seven hundred plaice caught in the
rth of Forth were transplanted to the Southern
orth Sea and liberated in the region of the "Hais-
oro'" lightvessel. A line of seven stations running
rth-north-east from Haisboro' across the south-west
the Dogger Bank was worked on the return journey,
well as a line of four stations from the region of
ucey's Garden to the Tyne.

B. FISH

I. General.

1. Statistics and Ichthyometrics.

ngland.

The collection of statistics and ichthyometrics has
en continued, and the number of the chief species
easured is approximately as follows:—

At Sea

Plaice	Haddock	Cod	Whiting	Total
939	55,849	13,306	331	70,425

On the Markets

laice	Haddock	Cod	Herring	Total
,020	1,765	36,877	104,493	189,155

The data for the haddock measured at sea were
alysed into length-frequency distributions and
rwarded to the Fishery Board for Scotland.

rance.

Measurements were continued according to the
me programme as before. The species studied
re:— Herring, mackerel, sprat, sardine, sand-eel,
d flatfishes.

Germany.

The collection of statistics relating to the grounds worked and the number of days fishing by German steam trawlers was continued at the ports of Bremerhaven—Wesermünde, Altona—Hamburg, and Cuxhaven by the fishery research laboratories of the Biological Institute, Helgoland, and the Sea Fisheries Institute, Wesermünde. Some monthly reports and an annual report (10) have been published.

Collections of statistics on grounds worked and duration of hauls made by the German cutters have been made at Altona—Hamburg market.

Holland.

Throughout the year market measurements have been made at Ijmuiden of the most important food fish from the North Sea, and of their market categories, where they are distinguished. More than 275,000 fish were so dealt with.

2. Experiments on the Fishing Capacities of Trawls.

Germany.

To enable the investigations made by the "Makrele" this year on the fish stocks of the German Bight to be placed on a comparable footing with the work done earlier by the "Poseidon", a trawling experiment was arranged in which both vessels took part. This occasion yielded interesting information on the variability of the size and composition of the catch in one place. A report on the findings is in the press (2).

II. Cod and Haddock.

England.

Observations on Grimsby market have been continued. As recorded in previous reports the stock of **cod** in the North Sea is considerably more heavily fished than in 1921—1930. This year it has been possible to make an estimate based on the average rates of survival of year-classes that ruled in 1933—1936, which shows that the weight put on by growth in the average stock that may be expected, will be reduced by about one fifth, as compared with 1921—1930. The valuable "large" cod, which are also the class of sexually mature cod, are to be expected only at one-third of their previous strength in numbers.

Germany.

Examination of the catches of fish larvae made on the cruises in the winter and spring of recent years shows that the displacements of the regional limits of **cod** spawning in the German Bight depend on the hydrographical conditions. In March 1935 and 1937, when relatively salt water advanced further eastwards, eggs occurred as far as east of Helgoland and off the mouth of the Elbe, while in 1926 the boundary lay 45 nautical miles west of Helgoland.

Small quantities of eggs and larvae of **haddock** were found in the German Bight only in March 1926. The

construction that may evidently be put on this is that the first of the very rich 1923 year-class, which was distributed well southwards, were mature in that year. An account of the quantitative investigations on the feeding of the haddock and **whiting** is being prepared for the press. The calorific value of the food has been taken into account.

Scotland.

The general features of the **haddock** stock will be found in the report of the Northern North Sea. The 1935 year-class dominated the hauls in the middle North Sea grounds between the Gut and the Dogger Bank, the 1936 brood being weakly represented. South of the Dogger Bank, the catches of haddock were almost negligible.

III. Herring.

1. Survey of Stocks and Landings.

Belgium.

The composition of the shoals of spent herring was studied as usual at the Ostend Laboratory.

Denmark.

Experimental fishing was conducted by Danish cutters on the Fladen Ground and north-west of the Dogger during August. The herring caught were examined for size, age, and race.

England.

The usual survey of the East Anglian herring stock has again been undertaken, and the sampling has covered the whole season from October to December.

On the markets at Lowestoft and Yarmouth 103,169 herrings have been measured in connexion with the detailed scheme for sampling the catches of the drifters, and at the laboratory 32 samples of 100 fish each were examined for age, length, maturity, weight, l_1 and Vert.S.

A forecast was issued in August and this has proved to be fairly accurate. The main age-groups were, as was expected, the fives and eights, but the catches at the time of the October full moon did not reach the high level which was mentioned in the forecast. That this was due to weather conditions, there can be very little doubt, for during the week of the full moon there was no wind at all, and the flat-calm sea was not conducive to good herring fishing. During the week following the full moon, a fresh breeze made conditions better, and the catches were heavy, suggesting that during the previous week the fish were scattered over the grounds and consequently were not caught in large numbers.

The beginning of the season showed that only few three-year-old herrings were present in the catches — in accordance with the forecast — but in the middle of November a large shoal of these young fish appeared mixed with the eight-year-old herrings whose appearance was quite normal.

These three-year-olds were much smaller than the usual fish of that age-group which visit these waters.

The actual abundance of each age-group in the shoals has not yet been calculated.

France.

The concentrations of herring in the Southern North Sea and the Eastern Channel were studied according to the usual programme. A report on the observations of the preceding year has been published (3).

The stock of herring present on the spawning grounds was characterized by an abnormal abundance of young three-year-old fish of small size. The attainment of sexual maturity was late; a delay of 10 to 18 days could be noted in the spawning on the principal grounds known. The composition of the stock may be provisionally expressed as follows:—

Winter rings ...	2	3	4	5	6	7	8
Age, Years.....	3	4	5	6	7	8	9
Year-Classes....	1934	1933	1932	1931	1930	1929	1928
Mean percentage	30	18	24	12	7	3·5	2·5

(These results are approximate only.)

Germany.

A small number only of market samples from the Southern North Sea was examined for length and age composition. The lugger catches were again charted in the usual way (see the report on the Northern North Sea).

Holland.

Investigations of the stock of autumn and winter herrings were undertaken during January-February and from October to December.

Scotland.

There was no systematic sampling of the herring shoals of the middle and southern North Sea during 1937. During a short survey of the middle North Sea a shoal of spawning herring was located during trawling operations at 55°42′ N. 0°32′ W. Practically the whole catch was lost through the bursting of the small mesh cod-end. The following are some details of 269 herring which were recovered. Ninety-seven per cent. were ripe and spawning (Stage VI) and three per cent. were spent (Stage VII) or nearly spent.

Age Composition Percentage

3	4	5	6	7	8	9	10	11-14 Years
14·9	13·4	18·6	**23·0**	3·3	7·4	7·8	6·7	4·9

Vertebrae

54	55	56	57	58	59	Mean
·4	4·2	48·0	44·0	3·0	·4	56·46

Keeled Scales (K_2)

13	14	15	16	17	18	Mean
1·9	24·1	47·2	23·0	3·0	·8	15·03

2. Rate of Growth.

ngland.

Growth calculations with special reference to the ngth l_1 have been made on all fish with five growth-ones on their scales taken in the samples during the ason. The data have been grouped into bi-weekly llections, and the completed series shows that these ve-year-old herrings are not the true (or Downs) sh, but are the result of an autumn spawning, i. e. ie length l_1 is 9—10 cm. while that for the true hannel spawned "winter" herring is about 7·5 cm. he four-year-old fish which visited the grounds in 936 have identically the same l_1 characteristics as iese present five-year-olds.

rance.

The investigations on the successive value of l_1, l_2, etc. in the various groups were continued.

3. Young Herring.

ngland.

Further collections of young herrings were again ken on the Northumberland coast and the variation length of these whitebait shows that they can be of in checking water movements in the north-eastern a. A report covering this is in preparation.

ermany.

In the trawling experiments with the "Poseidon" d "Makrele" it was striking that while considerable mbers of herring and sprat (more than 700 kg.) re caught in the cover net of the "Poseidon"'s gear, ere were only few fish in that of the "Makrele". The oseidon"'s net is presumably wider open when hing. The cruises of the "Makrele" consequently give information as to the occurrence of young herring.

4. Larval Herring.

ngland.

The collections of herring larvae from the Varne, lloper and Sandettié lightships have been and are ing continued. The material is being tabulated, with view to comparing the influx of larvae into the North a from year to year.

ermany.

The size composition, distribution, and frequency of currence of larval herring in the German Bight were udied on the "Makrele"'s cruise in March. A group larvae 14—18 mm. long was present in great num-rs over a large part of the region. In March 1926 and 35 larvae of this length were taken in negligible antities only. Considering the size of larvae observed other winter months, it is evidently the case that ese larvae were hatched in December—January. In mparison with 1926 and 1935 the bigger larvae, —25 mm. long, which were probably hatched in the emish Bight during November, were encountered in relatively small numbers and in a limited part of the region. This is in all probability to be associated with the localization of the centre of distribution of the November larvae unusually far to the south, as was the case in 1935.

In the experiments with artifically fertilized eggs from the Ems herring, we succeeded in bringing a greater number of herrings over the metamorphosis stage. Unfortunately the data so far obtained are not yet sufficient to provide a reliable average for the vertebral number. The breeding experiments will be resumed in 1938 in the light of the experience gained so far.

Scotland.

A few larvae were taken off Craster in September as far east as the prime meridian. Off the Tyne in October the numbers were slightly more abundant. On the western and south-western edge of the Dogger Bank, newly hatched stages were secured in large numbers.

Spawny haddocks were obtained from 4 to 6 miles SE. of the Longstone Light from 21st to 23rd August and again on 19th and 20th September, 5 to 7 miles E. by S. from the same position.

The Petersen grab (large and small types) was worked repeatedly on the Dogger region, but without success in securing herring eggs *in situ*.

5. Herring Races.

England.

Vertebrae counts for all the five-year-old herrings in the samples throughout the season have been made, and these counts show also that these herrings were not true Channel fish, but were probably from the autumn spawned stock from further north. The means are lower than from the usual East Anglian herrings.

France.

The material collected in 1937 is still under examination. It is evident, however, that the reduction of the mean vertebral number noticed in the different groups in several years past is still present in the samples taken in 1937.

Germany.

Vertebrae counts were continued on larval herring taken in the German Bight in winter and spring of the years 1929—1935, so that data relating to more than 10,000 fish are now available. In conjunction with these, observations were also made on the occurrence and construction of complex vertebrae. The computation of the data is still in progress.

Holland.

Race studies were undertaken on larval and young herring taken from the bays on the Netherlands coast in winter, and from the Wattenmeer in summer.

IV. Plaice.

1. Survey of Stocks and Landings.

Denmark.

Measurements were undertaken on Esbjerg market of the various market categories of plaice landed, in March, June, October, and November; altogether 18,558 fish were so dealt with, and otoliths were taken from about 500 of them. In the course of the year only small variations were noticed in the average lengths of the different categories.

Material relating to plaice of the 0-group was collected in the Wattenmeer area, as in previous years. Data on plaice, together with other fish, were collected in April, June, September, October, and November. The young-fish trawl was employed for this purpose, as in previous years. The average catch per hour was highest in September, when it amounted to 771 0-group fish; the numbers obtained in June, October, and November were 526, 109, and 170 respectively, all per one-hour hauls. The 1937 year-class seems to be better than the preceding year-classes (see Rapp. et Proc.-Verb., Vol. 105, II, 1937, where the average numbers for the years 1932—1936 by misprint are stated *per haul* which should read *per hour*).

According to the hauls made by the "Biologen" in the southern part of the Horns Rev region in June, the I- and II-groups together constituted 94 % of the stock between the 10 and 30-m. contours. Compared with the numbers of these two age-groups present in 1936, the actual numbers of the same age-groups in 1937 were about twice as great. On the other hand, the III-group formed only 5,5 % of the stock, the actual number being about half that of the same age-group present in 1936, and the IV- and V-groups had almost disappeared.

Plaice of the 1935 year-class had become mo numerous in this area to the extent of 229 % in co parison with the preceding year, as a result of t spread of fish of this year-class over grounds furth off-shore as their age and length increased. A fall the numbers of older year-classes was recorded, t decrease being still greater than that observed 1934—36 (see 8). Possibly emigration from the ar towards deeper water occurred on a larger scale 1937 than in the preceding years, and the diminutio in numbers of these year-classes is no doubt to b attributed to the combined effects of overfishing an emigration. The number of plaice of the III-grou (1934 year-class) present in 1937 fell to 23 % of t number of this year-class present in 1936 as II-grou fish. Similarly, the IV-group in 1937 (1933 year-clas amounted to only 2 % of the number of this yea class present as III-group in 1936.

Corresponding to this change in the composition the stock in the 10—30 m. depth zone, a decrea occurred of the number of plaice over 25 cm. in lengt in this region to 13 % of the number found in Jun 1936. On the other hand, the number of plaice 20– 24 cm. in length was the same in 1937 as in 1936, tha of 15—19 cm. plaice had risen by 25 %, and the were more than twice as many plaice of 10—14 cm

Regarding the replenishment of the stock of com mercially valuable fish upon which the live-plaic industry depends in this part of the North Sea, w may say, therefore, that the outlook has improved

Experimental hauls made in 1937 showed that th 1935 year-class was about as numerous as usual i the Horns Rev area, and the 1936 year-class rathe stronger than each of the four older year-classes.

The 1935 year-class seems to have been particularl strong on the northern part of the west coast of Jut land, where a dense stock of commercially valuabl

Table I.

Number of Plaice measured, weighed and otolithed.

Lowestoft

1937	Dead Small	Small	Best Small	Small Medium	Best Medium	Slabs, Large and Best	Tota
April	468	275	376	139	154	80	1,49
July	697	273	374	152	115	69	1,68
October	553	624	354	137	108	65	1,84
December	538	530	320	130	99	56	1,67
	2,256	1,702	1,424	558	476	270	6,68

Grimsby

1937	Chats	Small	Big Small	Middles	Best Medium	Large Best	Large	Tota
March	433	491	471	324	176	149	85	2,12
June	503	419	425	284	167	128	83	2,00
September	493	452	376	291	170	122	94	1,99
December	381	478	387	261	141	111	78	1,83
	1,810	1,840	1,659	1,160	654	510	340	7,97

ble II.

rcentage Number of Plaice landed in each Age-Group at Lowestoft and Grimsby in certain Months of 1936—1937.

Port	Date		Age-Group									
			II	III	IV	V	VI	VII	VIII	IX	X	XI+
		Year of Birth	1934	1933	1932	1931	1930	1929	1928	1927	1926	1925
imsby ...	Dec. 1936	Percentage	1·7	15·0	41·1	12·1	9·4	3·6	6·5	1·1	0·6	2·8
imsby ...	Mar. 1937	—	5·6	27·4	43·8	9·9	4·6	2·3	4·2	0·7	0·4	1·2
		Year of Birth	1935	1934	1933	1932	1931	1930	1929	1928	1927	1926
westoft..	April 1937	Percentage	0·6	10·8	33·0	38·8	7·9	4·7	1·7	1·9	0·1	0·7
imsby ...	June 1937	—	0·9	34·0	39·3	11·4	2·8	2·8	1·8	4·7	0·5	1·8
westoft..	July 1937	—	1·6	9·5	26·4	41·6	6·2	7·3	2·2	4·4	0·5	0·4
imsby ...	Sept. 1937	—	4·2	19·6	40·9	23·6	3·1	3·2	1·0	2·0	0·6	1·9
westoft..	Oct. 1937	—	2·8	27·8	40·0	19·6	4·3	1·9	1·2	1·9	0·1	0·3

ice of this year-class was located and worked by fleet during the autumn. Samples from the fisher-n's catches exhibited the following percentage ribution of the age-groups:—

-group	I	II	III	IV	V
Bovbjerg	0·4	67	31	0·7	0·4
	269 fish examined 15th Oct.				
Nissum Broad..		56	43	1	
	148 fish examined 28th Oct.				

n the occasion of the transplantation of plaice m the North Sea to the Belt Sea and the Sound, iths were examined from 792 plaice taken with Danish seine in April off Skallingen and west of adyb" lightship. These plaice were about 17—24 long, and the percentage distribution of the age-ps of the plaice transplanted was about as follows:

-group	II	III	IV	V	VI
r-class	1935	1934	1933	1932	1931
entage	8	74	17	0·6	0·1

he fishing operation with the "Eel-tog" in the sum Broad during July and September gave the wing average numbers of plaice of the different groups per 30 minutes haul:—

group	0	I	II	III
1937	—	243	168	11
ember 1937 ..	64	166	72	1

he I-group (1936 year-class) was somewhat less erous than usual, while the number of 0-group was about normal.

cording to the hauls made with the Johansen g-plaice trawl in coastal waters, the 1937 year-seems to be present along the coast north of gkjøbing Fjord in rather more than normal gth.

England.

The routine collection of each trade category of plaice was continued at Lowestoft and Grimsby. The number of fish which were weighed, measured, and otolithed is shown in Table I.

The 1937 material has been worked up, with the exception of the December samples at both ports, and the percentage numbers of each age-group shown in Table II may be compared with those for 1931 to 1936 given in the previous reports[1]).

The 1932 year-class (as the IV-group) continued to be the most numerous in the landings at Grimsby in December 1936 and March 1937, but in July and September the 1933 year-class (IV-group) predominated. At Lowestoft the 1932 year-class was the most abundant in April and July, but in October it, too, yielded first place to the 1933 year-class.

An examination of the data shows that the 1932 year-class grew rapidly, compared with the growth of the recent preceding year-classes. Its abundance, therefore, in the landings during 1936 and the early part of 1937 may be due, perhaps, to this more rapid growth, which would bring it into the stock fished by British steam trawlers at an early age, rather than any actual great abundance. This is suggested by the quick reduction in numbers, both actual and proportional. The 1933 year-class, moreover, shows no sign at present of being of more than average strength.

Germany.

Investigations on the plaice stock in the south-eastern North Sea, which have been undertaken on a reduced scale since 1934, were resumed in full in May 1937. The tests made to determine the relative fishing capacities of the trawls used in the "Poseidon" and "Makrele" enable the data from this cruise to be

[1]) See Rapp. et Proc.-Verb., LXXX, 2e partie, p. 44, 1933; LXXXIX, 2e partie, p. 44, 1934; XCIV, 2e partie, pp. 36—37, 1935; C, 2e partie, pp. 66—71, 1936; and CV, 2e partie, pp. 42—43, 1937.

Average Growth of Males and Females of Different Size-Groups.

A. May Experiments.

Experiment	Month taken for comparison	15—19 cm. ♂ f.	15—19 cm. ♂ av. l	15—19 cm. ♀ f.	15—19 cm. ♀ av. l	20—24 cm. ♂ f.	20—24 cm. ♂ av. l	20—24 cm. ♀ f.	20—24 cm. ♀ av. l	25—29 cm ♂ f.	25—29 cm ♂ av. l	25—29 cm ♀ f.	25—29 cm ♀ av. l	30 + ♂ f.	30 + ♂ av. l	30 + ♀ f.	30 + ♀ av.
Graa Dyb... May 1929	11th, 12th & 13th	1	1·5	—	—	11	3·1	7	3·6	4	4·1	6	3·3	—	—	—	—
Sylt..... May 1929	do.	—	—	—	—	23	4·7	5	3·5	9	4·6	5	5·0	—	—	—	—
Schiermonnikoog May 1929	do.	—	—	—	—	4	6·5	8	7·1	1	4·2	3	3·2	—	—	—	—
Haaks..... May 1929	do.	7	3·1	3	3·6	7	5·1	10	4·4	1	0·0	4	1·8	—	—	—	—
Haaks..... May 1930	do.	2	2·0	4	2·7	6	1·7	9	1·9	—	—	1	5·0	—	—	—	—
Schiermonnikoog May 1930	do.	—	—	1	4·0	2	3·1	9	3·0	2	4·9	6	3·2	—	—	—	—
Graa Dyb... May 1931	do.	7	4·8	2	5·8	13	3·6	7	5·4	4	2·8	5	5·0	1	5·0	4	5·9
Sylt..... May 1931	do.	11	3·0	8	4·6	27	4·0	23	4·5	8	5·5	12	4·7	—	—	3	5·9
Helgoland... May 1931	do.	2	3·5	2	8·0	13	2·8	8	3·9	10	2·6	11	4·8	—	—	4	3·9
Borkum .... May 1931	do.	8	3·1	3	5·3	20	3·1	15	3·0	3	5·0	5	2·7	—	—	1	3·1
Haaks..... May 1931	do.	10	2·7	7	4·8	8	3·2	14	3·0	5	1·2	7	2·9	—	—	3	2·3
Graa Dyb... May 1932	do.	3	3·4	1	0·0	12	1·2	8	2·2	4	3·1	3	2·9	1	1·9	—	—
Sylt..... May 1932	do.	4	0·8	2	0·7	4	2·0	9	2·0	2	2·6	8	2·1	1	2·5	4	5·1
Schiermonnikoog May 1932	do.	9	4·6	6	3·5	5	3·2	12	2·6	—	—	7	3·4	1	0·9	—	—
Haaks..... May 1932	do.	3	4·1	11	3·7	6	0·7	4	1·9	1	1·5	2	4·2	—	—	—	—

B. Autumn Experiments.

Experiment	Month taken for comparison	15—19 cm. ♂ f.	15—19 cm. ♂ av. l	15—19 cm. ♀ f.	15—19 cm. ♀ av. l	20—24 cm. ♂ f.	20—24 cm. ♂ av. l	20—24 cm. ♀ f.	20—24 cm. ♀ av. l	25—29 cm ♂ f.	25—29 cm ♂ av. l	25—29 cm ♀ f.	25—29 cm ♀ av. l	30 + ♂ f.	30 + ♂ av. l	30 + ♀ f.	30 + ♀ av.
Schiermonnikoog Nov. 1930	18th, 19th & 20th	—	—	—	—	6	2·6	9	3·6	2	2·6	12	4·3	—	—	1	1·0
Haaks..... Nov. 1930	do.	—	—	—	—	—	—	4	4·7	3	1·6	5	3·4	—	—	—	—
Terschelling . Oct. 1931	do.	6	4·2	7	5·5	13	3·1	8	4·2	3	1·7	3	4·0	—	—	1	4·7
Vye ..... Nov. 1932	do.	3	3·7	—	—	26	2·1	18	3·5	—	—	2	3·4	—	—	—	—
Sylt..... Nov. 1932	do.	3	1·3	1	0·7	8	3·1	20	2·7	2	5·6	2	3·9	—	—	—	—
Helgoland... Nov. 1932	do.	1	2·4	1	9·0	6	3·7	8	4·4	7	3·2	8	5·0	—	—	1	2·7
Borkum .... Nov. 1932	do.	4	3·9	5	4·3	6	2·3	8	3·2	1	6·6	4	3·9	—	—	—	—
Haaks..... Nov. 1932	do.	7	2·6	8	3·1	8	2·5	20	5·9	4	1·2	3	3·3	—	—	—	—

compared quantitatively with that obtained previously. Age determinations were made on 18,747 plaice in all.

The average hourly catch of plaice of age-groups II and upwards was from 1·6 to 1·4 times greater in the years 1931—1933 than in May 1937. Only the II, III, and IV age-groups had any share worth mentioning in the trial hauls this year. The 1935 year-class (II-group) is decidedly richer than that of 1927 and, on the average, seems to approach the strength of the 1925 year-class. The 1934 year-class (III-group) is also about equal in strength to the 1925 year-class and so is abundant in more than average degree. The 1933 year-class (IV-group), which was found in moderate strength on all previous occasions, occurs in remarkably small numbers. The 1932 year-class (V-group) is far more sparse, age for age, than even the 1926 year-class, notable for its poverty and rapidity of growth. This must be attributed to the intensive fishing of recent years.

Seventy-four samples of plaice (comprising abou 10,000 fish) from the landings by cutters at Hambur market were examined. The total landings by th high seas cutters were lower than in 1936, lower indee than in 1932. For the most part, the fishing wa conducted at a greater distance from the coast tha in earlier years, and plaice constituted less than hal the total catch. The number of voyages was con siderably less than in preceding years. Nevertheless as might be expected, the catch of plaice per day fishing was, on the average for the year through slightly higher than in the year before. Half th plaice landed (4·2 million fish) belonged to the 193 year-class (IV-group). The 1934 year-class (III-group took second place with 1·8 million, and the 1932 year class (V-group) third place with 1·4 million fish This result corresponds with the relative strengths o the year-classes and with the increase in growth-rate As was the case in 1930, the III-group contribute very largely to the landings this year also. It is certai

at in proportion to the actual abundance of the arious year-classes the profit derived from them by e German cutters is less than it was in 1930—31. his must be ascribed to the greater intensity of shing in the German Bight in recent years.
A report has been published on the 1936 plaice vestigations (15; see also 13 and 14).

olland.

Investigations on the plaice population of the Nether-nds coastal region were undertaken in May 1937; stations on 4 lines were occupied. About 6,000 aice were examined for age. The average catch per our off the West-Frisian Islands and off North Hol-nd amounted to 553 and 264 fish respectively, these alues being about the same as in 1934, although the group (1936 year-class) was generally much more ertiful than in the years 1931—1934. The age com-ositions in the two regions, however, exhibit very gnificant differences. While the II-group of the 1935 ar-class predominated in both localities to the extent about one-third of the catch, the proportion of group (1936) in the south was about double that in e north, and the proportions of the III- and IV-oups (1933 and 1934 year-classes) were accordingly uch smaller. The proportion of the 1932 year-class, V-group, was generally 11—12 %, although, in mparison with the lower proportions of the next unger groups, this year-class, admittedly poor in German Bight, is very clearly represented as being rticularly rich in the southern area, but off the est-Frisian Islands this feature is no longer distinctly cognizable.

2. Rate of Growth.

nmark.

In the southern Horns Reef Area in June the erage length of each of the age-groups I-III was cm. longer than in June 1936, when comparing the ne depth zones.

gland.

The rate of growth shown by the marked plaice IV, 3) varied from year to year and from station station. Generally speaking, fish marked off the st of Jutland (in the Horns Reef—Sylt area) grew re rapidly than those marked off the Frisian coast rderney—Terschelling area) and the Haaks, but difference was not always significant nor was it stant from year to year. In no one year was there ore rapid growth at all stations than in any other r. Probably no great error would be committed if plaice in the south-eastern North Sea were assumed have the same growth-rate, when considered over period of years, from whatever coastal nursery und they may have spread.
As an average of all experiments in the years 1929—32, the increments of growth made by plaice marked the Jutland coast, Helgoland, Frisian coast, and Haaks stations in May were, at the end of the first year:—

3·8 3·7 3·4 and 3·0 cm. respectively,

at the end of the second year:—

7·0 8·9 5·7 and 5·3 cm. respectively,

and at the end of the third year:—

7·6 5·8 and 8·4 cm. from the Jutland coast, Frisian coast, and Haaks stations respectively.
(Table XXII in the published work)

In the autumn (November) marking experiments, the average increments were somewhat different, namely:—

1·9 2·1 4·0 and 2·2 cm.

for the Jutland coast, Helgoland, Frisian coast and Haaks stations, at the end of the first year, and:—

4·7 6·1 5·6 and 6·6 cm.

at the end of the second year (cf. 7).

Germany.

The more comprehensive collection of data obtained in 1937 confirms our finding, previously notified, that growth has undergone acceleration. The average lengths of the age-groups II to VI were slightly greater in May 1937 than in May 1929. The year-classes 1932—1935, which are present to-day, have experienced the same rapidity of growth as was exhibited by the 1925 and 1926 year-classes. In consequence of this, the plaice reach marketable size at an earlier age. Already 42 % of the IV-group were over 23 cm. long by May 1937.

Holland.

Calculation of the average lengths of the age-groups of plaice taken in May 1937 gave the surprising result that as compared with 1934, the mean lengths in the West-Frisian region have fallen and are no longer in excess of those in the German Bight, where the lengths have risen considerably since that time. Off the coast of the Province of North Holland a substantial diminution of the average length of the V-group is to be recorded.

3. Marking Experiments.

England.

The English plaice marking experiments of the years 1929—1932 have been published (7).

Scotland.

During the first week of October, a total of 720 maturing plaice was caught on the north side of the Firth of Forth and transferred in trays in the sea water tank of the "Explorer" to the Southern North Sea. Mortality during transit occurred to a small extent only in the lowest layer of the tank, due largely to insufficient water circulation, and a total of 637

was liberated about $3^1/_2$ miles north from "Haisboro'" lightvessel at the position 52°59′ N. 1°29′ E. These consisted of 325 males and 312 females, ranging in size from 24 to 52 cm. Eighty-three per cent. of the males were 28 cm. and over in length, while eighty per cent. of the females measured 33 cm. and above, so that the transplanted fish were mostly of mature size and age. The results so far obtained indicate that the behaviour of the fish in this experiment would appear to be similar to that exhibited during the experiment made by GARSTANG on the Leman Ground in 1904, *vide* Int. Invest. Mar. Biol. Assoc., Report III, 1909, Chart I.

4. Eggs and Larvae.

England.

Weather interfered with the plaice egg cruises to such an extent that the material was useless for statistical purposes. The work in the "Varne", "Galloper", and "Sandettié" lightships is being continued.

Germany.

The catches of pelagic fry obtained on the German cruises in the winter and spring of recent years have been examined, and a paper on them by Dr. AURICH is in course of preparation. For plaice, the results are as follows:— In February (1936) eggs were found in fairly large numbers (over 100 per m.²) not only in the northern-most part of the Flemish Bight, as was to be expected, but also in the neighbourhood of the Oyster Ground (100—300 per m.²). This area is separated from the rich Flemish Bight region by a poor zone abreast of Terschelling. Inside the German Bight eggs are much less plentiful.

In March (1926, 35, 37) the early stages of eggs occur in greatest abundance near Helgoland. The largest numbers of larvae are to be found further seawards, presumably originating from the Flemish Bight and the Oyster Ground. In April (1932, 1936) and May (1929—1931, 1933) only a few larvae are present in the German Bight, though in May 1929 a small quantity of eggs was recorded. In that year, apparently, spawning was retarded by the very cold conditions.

5. Racial Investigations.

Denmark.

Race investigations were conducted on plaice and dab taken by the "Biologen" in the Horns Rev area; on plaice from the Horns Rev area and off Thyborøn in the course of the transplantations from the North Sea to the Belt Sea and the Limfjord; and finally on plaice from commercial catches made off Bovbjerg and in Nissum Fjord in October.

V. Common Sole.

Denmark.

Material was collected for determining the ages of the soles caught by the "Biologen".

Germany.

Material for the age determination of soles was collected in the usual manner from all experimental hauls. During the "Makrele"'s cruise in the German Bight in May (7th—12th, 18th—20th), further observations were made on the occurrence of the fry of sole, to supplement the data already in existence. Except at the outermost stations, where the water was comparatively deep, fry were encountered throughout the area studied, though nowhere in particularly large numbers, which is in agreement with the findings of earlier years. It is intended to combine all the observations so far made and to publish the results, after the termination of one more cruise to be undertaken later in the season (June).

VI. Other Fish.

Belgium.

Sprat investigations were continued during the fishing season.

Denmark.

The ages of the **dabs** taken by the "Biologen" in the Horns Rev area were determined. The fish of all species other than those mentioned above, which occurred in the research-vessel catches, were measured and recorded. Similarly, the fish of all species caught in the "Wattenmeer" area were recorded and some were measured. Race investigations on the dab were undertaken in conjunction with similar work on plaice.

England.

Sprat. The Ministry's work during recent years has been published (11).

Germany.

In the course of the examination of the catches of fry made on the cruises in the winter and spring of recent years, information was obtained on the spawning of **dab, flounder, turbot, brill, whiting, mackerel, sprat,** etc.

In regard to the **sprat**, AURICH is able to distinguish three regions of intensive spawning; in one of these, off the entrance to the English Channel, there were more than 100 to 300 eggs beneath a square metre surface when spawning was at its highest. A second, indistinctly separated from the first by a relatively poor zone, and lying off the East and North Frisian Islands, gave 100—400 eggs beneath a square metre surface. The third covers the region of the Jutland Bank, Great and Little Fisher Banks, and the entrance to the Skagerak. Large quantities of fry are carried by the current away from here into the Skagerak. In this area, up to 900 eggs under the square metre surface were found in June 1930, and up to nearly 2000 in May 1929. In accordance with temperature conditions, spawning begins earlier in the Flemish

han in the German Bight, where it is again earlier han on the Jutland grounds.

Eggs of the **anchovis** (up to 24 under the square netre surface) were taken in May 1933 and June 1930 abreast of Borkum, Norderney, and Sylt, and sporadically in May 1937 off Sylt and Röm.

C. SHELLFISH

Belgium.

Investigations were continued on the local **shrimp** ishery and the biology of the shrimp.

Germany.

Artificial breeding of **oyster** larvae was continued n the summer of 1937 at a new Government station n the Island of Sylt. Fairly large quantities of spatall were successfully obtained. Difficulties are experienced for the time being in rearing the spat vithout heavy losses. The experiments are being ontinued. Good results were obtained with the seed ysters imported from France.

In connexion with the **mussel** culture lately begun n the German coasts, bacteriological investigations reliminary to sanitary control were undertaken. No aults were found with the export mussels.

A study of the natural history of *Cancer pagurus* as begun at the Biological Institute, since this pecies, which is taken as a side-line in the lobster shery, is now put to economic use.

D. BENTHOS AND DEPOSITS

enmark.

In 1937 the Skallingen Laboratory continued its ork along the lines followed for a number of years ast. A motor-boat has been acquired by the laboratory for work in the Wattenmeer. The boat, which, nder weigh, draws 65 cm. is equipped for physiographical and biological work of various kinds.

The hydrographical and biological researches in lo Bay have been continued (by Dr. H. Thamdrup) nd a number of investigations in that part of the Vattenmeer belonging to the hydrographical area of raa Deep have been completed. In addition the reliminary work for a geographic survey of the Vattenmeer north of a line between Højer and avneby (Romø) has been carried out.

The ecological investigations on various shore sects have been brought to an end with a study of he salt preferences of these animals (by Dr. E. Brohansen).

The experiments begun in 1931—32 for measuring he rate of sedimentation by Nielsen's methods have een continued. The sand dyed with Sudan-Red has roved to hold its colour very well, and will probably ntinue to do so for 10—15 years. These sedimentaon measurements have confirmed the conclusions ated in a previously published paper (Niels Nielsen: Eine Methode zur exakten Sedimentationsmessung. Kgl. D. Vid. Selsk. Biol. Medd. 1935).

Bottom samples with the Petersen grab (0·2 m².) were taken at all stations occupied by the "Biologen". At certain stations samples were taken with the van Veen bottom sampler, for purposes of comparison.

France.

Material collected by the "Président Théodore Tissier" has been studied. Sedimentation is active south of 54° N. The currents are recovering and remodelling the ancient formations of sand and clay, notably those of the Dogger Banks. In the south of the region and in the Straits of Dover many sandstone and granite boulders, of exotic origin, are to be found as erratic blocks at numerous points in the surface of the submarine bed.

Germany.

On the occasion of the comparative trawling experiments in May 1937, 10 bottom samples were obtained from the "Poseidon" with the weighted Petersen grab (0·1 m².) at each of 3 stations in the *Venus-Gallina* community region. As far as the feeding conditions of plaice are concerned, there are characteristic differences between these stations which may be summarized as follows:—

1. In fairly pure sand, which presented a floor that was firm, though movable by the ground swell, we recorded abreast of Westerland in 14 m. of water only 2·34 g. of benthic animals per 1 m²., comprising about 0·7 g. *Tellina fabula*, 1·57 g. Polychaeta (mainly *Nephthys* sp.), and 0·07 g. small crustaceans (Amphipoda and Cumacea).

2. At the station by the "Amrumbank" lightship, depth 20—23 m., the sand was slightly adulterated with mud, though, with the exception of one sample, was still very firm. Echinoderms, which were absent from Westerland, occurred here. In consequence, the crude weight per 1 m². rose to 160·7 g., though the major part, 155 g., consisted of medium-sized *Echinocardium cordatum*, which are not eaten by plaice. The remaining 5·7 g. comprised 4·52 g. bi-valves (*Tellina fabula*, *Mactra stultorum*), 1·09 g. Polychaeta, 0·05 g. small crustaceans, and 0·04 g. *Ophiura juv.*

3. At the station on the so-called "Krautplatz", north of Helgoland, a smooth depression, about 25 m. deep, with a floor of sharp sand mixed with mud, yielded catches the crude weight of which was 104·84 g. per 1 m². Of this also *Echinocardium cordatum*, at 91·5 g., formed the greater part. Animals serviceable as plaice food were better represented, however, than at the first two stations; of the 13·34 g. of these, bivalves made up 10·2 g., polychaets 2·61, small crustaceans 0·03, and *Ophiura* 0·5 g. As opposed to the production on the soft mud bottoms farther off-shore, these values are still very small.

Additional work with the grab was undertaken in the neighbourhood of the Dogger Bank and Oyster Ground, as opportunity offered. The detailed survey of the deep water gut south of Helgoland, begun in

the preceding year, has been brought to a close. A report on the bottom relief, sediment, and distribution of organisms will shortly be published in the Wiss. Meeresunters. of Helgoland. The report on the shore-life at Königshafen, Sylt, has been published (18). The communities peculiar to the Jade Basin have again been investigated, as before. A paper on the tidal zone is at present in the press.

Investigations have been started on the micro-fauna. Studies on Tardigrades (4) and a *Saccoglossus* (6) have been published, and others are in preparation. Research on the young stages of bi-valves occurring in the German Bight have been continued. A note on the developmental stages of the Brachyuran *Erocheir sinensis* MILNE EDWARDS, which has been imported into the German rivers, has been published (5).

E. PLANKTON

England.

Nine plankton cruises of the research steamer "George Bligh" and eight short cruises of the motor drifter "Onaway" were made during 1937, as follows:

1. Investigations on the ether-soluble matter of dried plankton (a) along the English east coast area (June and October), (b) monthly observations at six stations between Flamborough Head and the south-west patch of the Dogger Bank (January to December).

2. Plankton of the northern grounds. Three parallel lines of stations across the North Sea, the northernmost line crossing from off the Northumberland coast to off the Naze (May).

3. Investigations into the relation between abundance of plankton and the hydrological conditions (April and August).

4. The relation between phytoplankton concentrations and the autumn shoaling of herring off East Anglia (October, November, and December).

The six routine Hensen-net stations worked each month between Flamborough Head and the Dogger Bank, together with the two cruises covering the area off the English east coast, which have now been made regularly since 1932, were continued in 1937. The specific composition of plankton from these areas has been characterized by the abundance and extent of *Rhizosolenia styliformis*, which was found in the Flamborough area throughout the greater part of the year. The ether-soluble matter content of catches parallel to those taken for biological estimate was higher in the northern part of the region covered by the June cruise than for any other comparable period during the years investigated. At one station, consisting almost entirely of *Calanus finmarchicus*, the ether-soluble matter was over 40 % of the dry weight. On the October cruise these values were rather higher than the average.

Analysis of Phosphate. In April phosphate was found to be low in the Southern North Sea, except off Lowestoft and off the River Thames. The English Channel was also characterized by low values excep off the Isle of Wight, where moderate values wer found. There was a fair growth of *Phaeocystis* in th Southern Bight. In August, when *Rhizosolenia styli formis* was found in small quantity, most of th Southern North Sea was poorly supplied with phos phate, but there was a patch of richer water on th Dogger Bank and another extending from the Thame estuary, although not so far seaward as in previou years. Colour of water and transparency were observe on this cruise by three different methods, and it wa easy thus to distinguish coastal from more oceani water. *Rhizosolenia* was near the northern, mor oceanic, water.

The following paper is ready for publication: "O the Occurrence and Nutrition of Microscopic Plant that harm the Herring Fishery of the Southern North Sea."

From 4th May to 29th July investigations wer carried out on the relation of *Calanus* to the catche of herring made by drifters working from North Shields. A report on the results is in preparation.

The usual autumn survey of phytoplankton con centrations in the Southern North Sea was carrie out during October, November, and the first half o December. In early October the diatoms *Rhizosolenia styliformis* and *Biddulphia sinensis* were found in two dense patches which overlapped more than usual These concentrations were situated between 53°30′ N and 54°30′ N. Lat., and 0°30′ E. to 3°30′ E. Long. covering an area of over 6,000 square miles. Towards the end of October both patches of diatoms had increased in density and extent, but had drifted some 30 miles to the east and north-east. During November both concentrations had decreased considerably in density and area, while in early December the quantities had dwindled to almost negligible proportions. The shape of the *Rhizosolenia* patch was more complex than usual, the effect of the south-west Dogger Bank swirl being less pronounced than in former years. *Biddulphia sinensis*, which has for some years been found in dense concentrations in the south-west of the Southern Bight, was very sparse in that region during the autumn of 1937.

It appears very probable that the large and dense concentration of diatoms present in early October had an adverse effect on the shoaling of herring at that time, and was partly responsible for the late arrival of the shoals on the fishing grounds.

Two papers have been published (12, 17).

Germany.

Surface plankton investigations have been conducted on the same lines as before. Samples were collected on cruises of the research vessel "Makrele" in the German Bight in March and May.

On the "Makrele"'s cruise from 1st to 19th March the distribution of the macroplankton in the German Bight was studied. The observations thus made bring to a final conclusion the work on the winter distribu-

on of the indicator species in the macroplankton in ıe Southern North Sea that has been in progress for number of years. They were designed chiefly to ıeck previous findings, and, consequently, added ɔthing to the general results of the earlier cruises, ɔcept in so far as the list of indicator species for aters of northern origin has been enlarged by most markable catches of Euphausidae. *Thysanoessa raschi*, *h. inermis*, *Nematoscelis megalops*, and *Meganyctiphanes norvegica* were recorded over a region some 5 to 100 miles west of Amrum-Sylt, and the last-amed species was also found on the southern part the Oyster Ground, in Lister Deep, and close to elgoland. A report has appeared on the winter ankton of the southern North Sea (9).

The distribution of the macroplankton was again udied on the "Makrele"'s cruise in the German ight from 7th—12th and 18th—20th May. This uise was designed to repeat the work in the warmer ason of the year, and at the same time to supplement e material obtained on the cruises in previous years. s is always so at this time of year, the coelenterates rmed one of the chief components of the macro-ankton. Here and there, the Anthomedusa *Rathkea opunctata* was exceptionally numerous; near the ast, off Borkum, they amounted to over 6,000 neath 1 sq. m. of surface. Taking into account the doubted reduction by *Phaeocystis* of the filtering pacity of the quantitative vertical net, the numbers corded were evidently too low. The occurrence, on rious occasions, of the polyps of *Margelopsis eckeli* as early as May is also worth mentioning. *ngainvillia macloviana* (see Künne, Zool. Anzeiger l. 101, 1933) was again found, a further sign that is subantarctic medusa has in fact become naturaed in the North Sea. *Oikopleura labradoriensis* was und in a region about 70 miles west of Lister Deep—nö.

cotland.

The nets in use were the Hensen, Standard, Hjort ne Silk, 2-metre Stramin (vertical) and 1-metre ng (horizontal).

Phytoplankton. A dense patch of *Rhizosolenia liformis* was found on the south-western edge of e Dogger Bank at the end of the first week in Octor, but was apparently rapidly dying out, as enorms numbers of empty shells were found on both sides this patch. *Ceratium tripos* and *furca* were distrited generally but apart from *Rhizosolenia*, phytoankton was very poorly represented at the time of e observations.

Zooplankton. In July, *Calanus* was scarce in the dle North Sea between the Gut and the Dogger nk and the catches were composed largely of young ges. Off the Northumbrian coast adults and late pepodid stages, however, were observed in abunnce. Concentrations in the Longstone area have been served in the other years and the significance of is phenomenon is being investigated more closely. *gitta setosa* was present in abundance at the offshore stations and was associated with *Aglantha* and *Oikopleura*.

At the end of September and during the first week in October, fairly rich general plankton was encountered off the Northumbrian coast, and was characterized by the presence of *Calanus* and *Sagitta elegans*. Metamorphosing asteroids were as usual at this time of year quite common in this area. *Obelia* and *Aglantha* were widely distributed and abundant over the Dogger Bank Area, but other medusae, e. g., *Tima*, *Turris*, *Laodicea*, *Aurelia*, and *Cyanea* occurred only as isolated specimens. *Limacina* was moderately abundant but patchy in distribution. *Sagitta setosa* occurred in great numbers on the western edge of the Dogger Bank. A few doliolids (*D. gegenbauri*) were observed at the southern end of the Gut (rectangle E 10a).

F. HYDROGRAPHY

Holland.

The customary surface observations of temperature and salinity from liners and lightships in the Southern North Sea have been continued without change. During October and November surface samples were collected by H.M.S. "Nautilus" on sections between 52°30′ N. and the line Dover—Calais. Since 1st July 1937 continuous surface current observations have been carried out by the Rijkswaterstaat with the "Vertical log" on board the "Maas" lightship. A paper on these investigations was published (16).

All samples were titrated at the Fishery Institute at Den Helder.

Norway.

Observations of surface temperature and salinity have been taken on the steamer routes Bergen—Newcastle and Bergen—Rotterdam.

Scotland.

The hydrographic features are reported elsewhere. Generally speaking the year 1937 was characterized by a relatively weak Atlantic influx into the Northern North Sea, while the actual effect was experienced much later than is normally the case. At the end of September and beginning of October summer conditions as evidenced by thermal layering were still in operation east of longitude 1° W. off the Northumbrian coast and north of the Dogger Bank. South of the Dogger, homothermal conditions were experienced, but the surface temperatures (14 to 15° C.) were higher by two degrees than those obtained in the northern sector.

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TRANSITION AREA COMMITTEE

1937.

Dr. H. Blegvad.

Denmark.

iology. (Dr. H. Blegvad).

The vessels used for research work in 1937 were: ie S/S "Biologen" (April—October) and a motor-oat (July—August).

Plaice. Fishing experiments with the "Tog" were rried out throughout the Transition Area, as in rmer years. The stock of young fish (year-classes 935 and 1936) was about normal in the northern attegat, and somewhat above normal in the Skage-k. In the south-western Kattegat the stock of ounger plaice was rather low, and in localities where rmerly the young plaice were abundant considerable umbers of flounders were recorded. In the Belt Sea e stock of I- and II-group fish was about normal, e 1935 year-class being richer, the 1936 poorer an normal. In the Baltic waters south and east of e Danish islands all the younger year-classes were ly poorly represented.

During the autumn unusually large commercial tches of young plaice were taken along the Skage-k and the northern part of the Danish North Sea asts. According to analyses about 90 % of the aice in the catches belonged to the II-group (year-ss 1935). During the fishery about 500 plaice were arked.

The Johansen young-plaice trawl was used along e coasts during the summer from a motor-boat ee Figs. 1 and 2). Along the west coast of Jutland d in the northern Kattegat the catches of the roup were slightly above normal, in the southern attegat considerably above normal. In the Belt a and the Sound the 0-group was normal or a tle below; in the Baltic the catch was — as in the eceding years — very small.

Transplantation of undersized plaice from the rth Sea to the inner Danish waters was continued an increased scale. During April—May 184,450 kg, about 2,026,000 individuals, were transplanted to e Belt Sea, the southern Kattegat, the Sound and e western Baltic (in former years the weight of ice transplanted was about 110,000—130,000 kg). e transplantations of plaice from the Thyborøn area to the inner broads of the Limfjord were continued, 138,000 kg or 1,803,000 fish being moved.

Smaller quantities of undersized plaice from the North Sea off Thyborøn were delivered to the Swedish Government and liberated in the eastern Kattegat, the Sound, and the Scanian coast of the Baltic.

The results of the Belt Sea transplantations were satisfactory in all respects; analyses of commercial catches during the winter 1937/38 show that in various places, especially in the Little Belt, the transplanted plaice constitute a considerable proportion of the plaice caught by the fishermen.

Other flatfish. Investigations of the biology of other flatfish (especially flounder and dab) were continued. In the northern part of the Belt Sea the stock of young dab was growing, as was the case in 1936, no doubt as a result of the size limit (25 cm.) introduced in 1934. In the southwestern part of the Kattegat a fairly heavy stock of young flounder was found.

Cod and other Gadoids. Ring-trawl fishing in spring showed that the stock of cod larvae was about normal in the waters inside the Skaw. The stock of younger cod (I- and II-group) was somewhat below normal.

Herring. The extent of the spawning of the autumn herring was examined. Throughout the southern Kattegat, the Belts, and the western Baltic the stock of larvae was exceedingly poor. The yield of the autumn herring fishery was also very small.

Sprat. Investigation of the trawl fishery for sprat in the Belt Sea has been continued. The catches consist mainly of sprat and small herring. Bottom stages of cod, plaice, etc. are but rarely seen in the catches.

Mackerel and Eel. Forecasts of the yield of the fishery were published in "Dansk Fiskeritidende" (by Aage J. C. Jensen).

The investigations concerning the fishery for **Norwegian Prawn** and **Norwegian Lobster** were continued. The fishery is still increasing in intensity; certain regulations, undertaken jointly by the Scandinavian countries, to protect the stock, are desirable.

Fig. 1. Number of plaice of the 0-Group (year-class 1937) taken per fishing unit in the summer of 1937. The fishing unit used was a 30 minutes haul with the Johansen young-plaice trawl.

Fig. 2. Number of plaice of the I-Group (year-class 1936) taken per fishing unit in the summer of 1937. The fishing unit used was a 30 minutes haul with the Johansen young-plaice trawl.

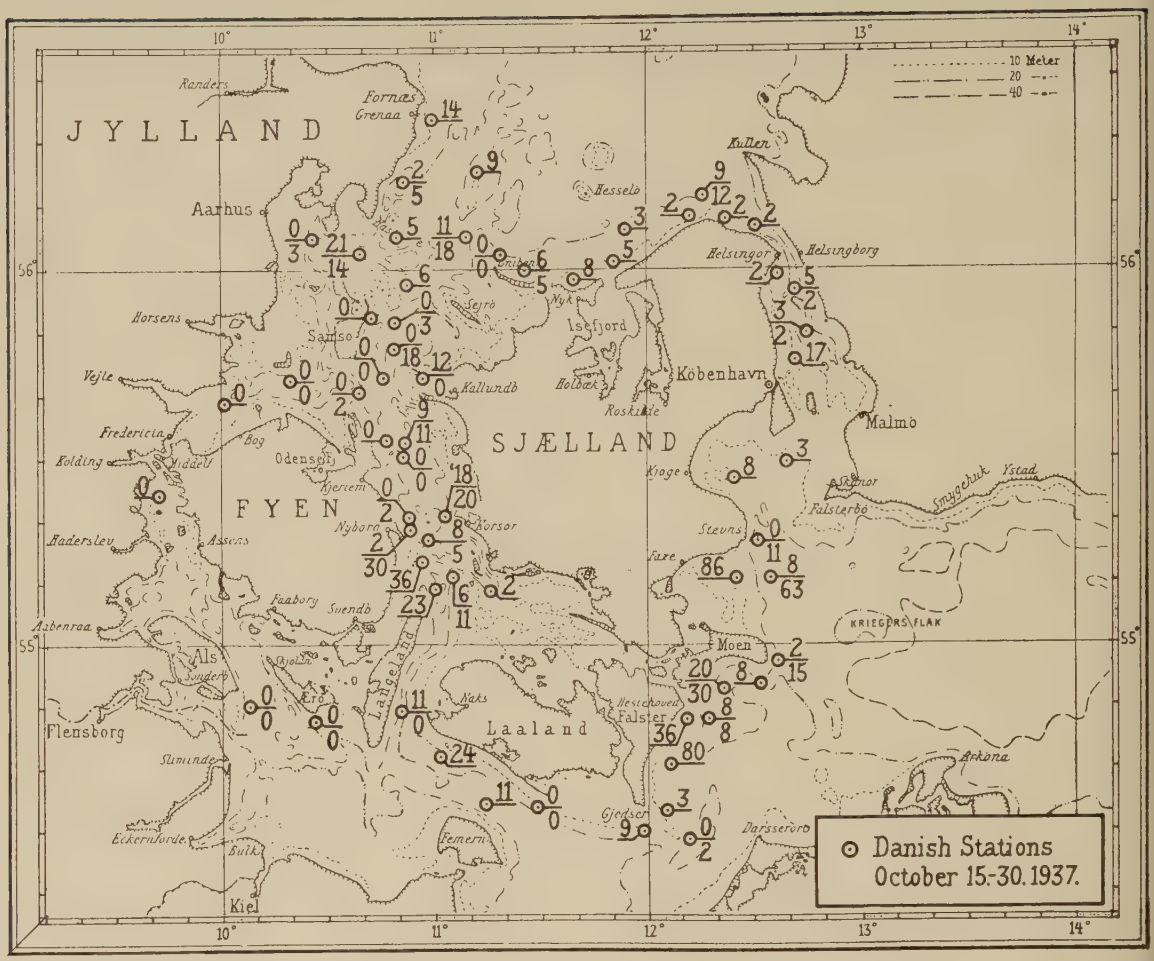

Fig. 3. Total number of herring larvae taken per 30 minutes haul with a 2 metres stramin ring trawl in the autumn of 1937. — Where more than one figure is given at one station, the upper one indicates catch in the upper layer (0—15 metres depth), the lower figure catch near the bottom.

The Mitten Crab has in 1937 been observed again in a few new localities, but single specimens only were seen.

Bottom Invertebrates. As in former years, valuations of the sea bottom have been undertaken by means of the Petersen bottom sampler. During the late summer investigations in the Limfjord it was observed that the bottom in the Limfjord over large areas was "rotten" and evil-smelling; in such areas none or scarcely no bottom invertebrates were found (newly dead mussels were, however, present in considerable numbers). The fact that in the autumn the fishermen found that the plaice transplanted in spring to these areas were lean and comparatively small is in accordance with this observation.

Plankton. As in former years, vertical hauls with nets of fine gauze and with Hensen net have been made from various lightvessels in the Kattegat and the Belts. Vertical hauls with the Hensen net were carried out in connexion with the ring-trawl fishing.

Investigations of **Fish Diseases** and of the **Diseases of the Eelgrass** were continued. In certain localities in the Belt Sea and the Limfjord a new growth of eelgrass has appeared, but on the whole the state and extent of the disease is as it was before.

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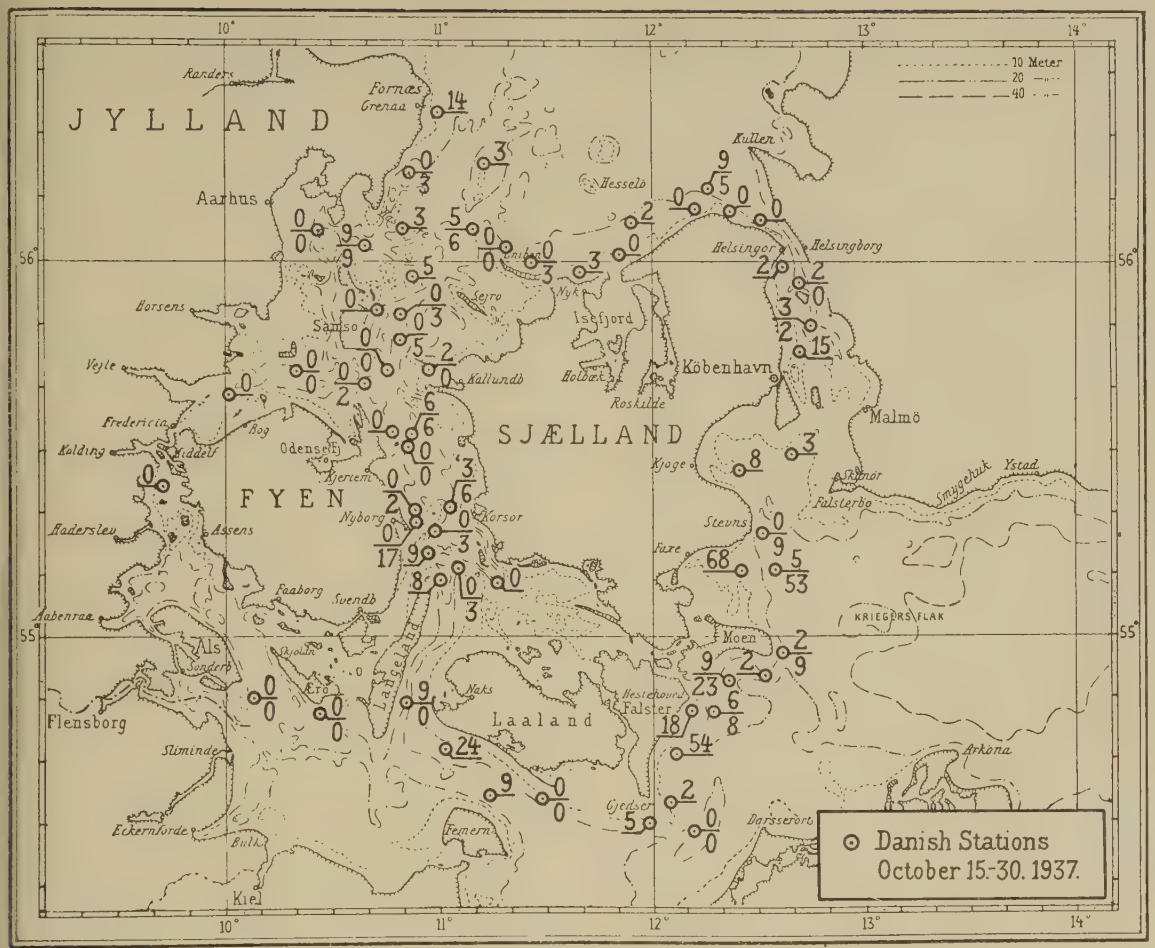


. 4. Number of herring larvae of 5—9 mm. length taken per 30 minutes haul with a 2 metres stramin ring trawl in the autumn of 1937. — For explanation of figures, see Fig. 3.

Germany.

partment Hamburg-Kiel. (Dr. S. Strodtmann.) During 1937 research cruises were undertaken as lows: February—May, cruises with the patrol ssel of the Fisheries Inspector of Kiel (Oberfisch-isteramt) in Kiel Bay; June—July, cruises in meranian waters with cutters, and in July—August the western Baltic; September, a cruise with the earch vessel "Poseidon" to the southern Baltic as as Gothland and the Kurische Nehrung.

laice. A total of 73 hauls was made with the ansen trawl between 20th July and 19th August various coastal positions in the western Baltic; total duration of the 73 hauls was 13 hours, and catch was 23 fish of the I-group and 38 of the roup (Figs. 1 and 2). This confirms the finding t the 1936 year-class is very poorly represented. e year-class 1937, evidently, cannot be expected to be better represented, as it was not caught in greater numbers anywhere in spite of the greater number both of hauls and positions investigated. Accordingly, neither of these year-classes have been able to improve the stock.

On the Pomeranian coast, near Kolberg, only 10 plaice of the 0-group were counted among the catch of some 1,800 comparatively small flounders taken by the "Schlepphamen" (tow-net); their length ranged from 4 to 7 cm., average 5·4 cm. At about the same time hauls were made with the "Krabbentrawl" (shrimp-net) from the R/V "Poseidon" at depths from 9 to 36 m., in the Pomeranian Bay and off Kolberg. The yield was very poor, the average of 28 hauls being one plaice of each of the groups 0 and I per haul of 30 minutes duration. It follows that in the eastern Baltic also the 1936 and 1937 year-classes have contributed little to the replenishment of the stock. The most eastern locality at which plaice of the 0-group

were recorded in the catches was off Stolpmünde (4 fish in 30 minutes); they measured 3 to 5 cm. (average 3·8 cm.) and were thus noticeably smaller than those from the shallow coastal water.

The proportion of 0-group bastards between plaice and flounder, which are hardly recognizable from their appearance, amounted to 16 % in the western Baltic and to 12 % in the Baltic proper.

The density of the year-class 1935 (II-group) in Pomeranian waters was fair and thus agreed well with previous investigations; it even outnumbered, occasionally, in coastal waters the rich year-class 1934. This year-class (III-group) has helped to bring about increased landings of plaice, thanks to its numerous occurrence, as was forecast in last year's report. The landings in 1937 were 5 times those of 1935, probably 2·5 million kg., the greatest quantity since 1928. Owing to the year-class 1935 being of medium strength only, and the year-classes 1936 and 1937 both being very poor, the good yield of 1937 cannot last very long and will be followed by another fall in catches.

Flounder. Investigations into the occurrence of flounder larvae in Pomeranian waters show that there are noticeable variations in season from year to year. In the year under review they were caught as early as the beginning of June, and generally — as in the preceding year, though a month later — north-east of Sassnitz, where the depth is 19—35 m.; some were already in the metamorphosis stage. Even immediately off the coast and on the Oderbank a few isolated larvae were caught. In agreement with earlier observations they kept chiefly to the warmer upper layer (5—10 m. depth). In contradistinction to 1936, no larvae were caught in the beginning of July.

In the area from Rügen to the Kurische Nehrung several good catches of flounders in the 0—II-groups were made by the "Poseidon". These confirmed the observations of earlier years that the growth-rate diminishes rapidly towards the east. The average lengths of the I- and II-groups were 8·8 and 15·5 cm. respectively off the East-Prussian coast, 12·1 and 17·7 off Kolberg.

Turbot. The investigations into the occurrence of larvae in the Oderbank area, started in 1936, have been continued and were supplemented by artificial fertilization and rearing of eggs. The eggs developed very well both in Baltic and North Sea waters, but floated in the surface in the North Sea only. Their specific weight corresponded to sea water of 25 ‰ salinity. Hatching began after $2^1/_2$ days at a temperature of 19—21° C.

Long rough dab (Drepanopsetta). With the influx of strongly saline waters in the beginning of May many larvae seem to have drifted into the western Baltic. In Fehmarn Belt 17 larvae were caught in a 20-minute haul with the Petersen young-fish trawl. At depths below 20 m. the salinity was 29—31 ‰.

Cod. The spawning of the cod in Kiel Bay was studied on research cruises made at intervals of 2 to 3 weeks. The greatest density of eggs (312 per m^2.) was found at the end of March and in the middle of April. Consequently, larvae were very numerous.

During the fish-fry investigations in June in Pomeranian waters a good number of cod larvae were caught together with larvae of flounder (maximum 23 fish in a 20-minute haul). In July, no larvae were caught.

During the September cruise of the "Poseidon" an intensive spawning of cod was noticed in the Bornholm Deep (up to 183 eggs per m^2.) and, in a somewhat lesser degree, in the Danzig Deep. An investigation into the morphological characters of the spawning fish showed a difference of the vertebrae, viz., 52·0—52·1 against 52·5—52·6 in fish spawning during spring and early summer. An autumn-spawning variety thus seems to live in this part of the Baltic. A publication dealing with these novel observations is in preparation.

Herring. The distribution of larvae of the spring herring was closely studied during a cruise in the beginning of June round Rügen and into the Pomeranian Bay. The larvae were caught in extraordinarily large quantities in the Greifswalder Bodden, in the eastern part of the Strela Sound and in Swinemünde Bay, whereas they were scarce in the waters to the west, north, and east of Rügen. They occurred in two clearly defined size-groups (10—15 and 20—25 mm.). In the Greifswalder Bodden and the Strela Sound both groups were represented, with the larger one predominating in many places; in Swinemünde Bay, on the other hand, the very large catches consisted almost exclusively of small larvae. The occurrence of these two size-groups can be explained by the occurrence, in the preceding spring, of two large shoals of spawning herring, in March chiefly in the Greifswalder Bodden and the Strela Sound, in April in the Bodden again, and, chiefly, in Swinemünde Bay. At the proper times good herring catches were made at the places referred to, while the fishery off Hiddensee and in the bays of Lohme and Binz, which used to be very good, yielded poor results only. In the beginning of July both groups could still be traced; the larger one had attained lenghts of 30—37 mm. and was in the metamorphosis stage, the smaller one had grown to 23 mm., though many larvae were only 15 mm. or less.

Fish Eggs and Plankton. On the "Fehmarn Belt" lightvessel hauls with the Hensen egg-net were made regularly three times a month. These catches, together with the material from the above-mentioned cruises in Kiel Bay, are expected to yield a fair survey of the existing conditions of reproduction of food fishes in this area. Special consideration is to be given to the occurrence of larger plankton animals (medusae, decapod larvae).

Publications. R. Kändler: Beobachtungen über die Laichzeiten der Ammodytes-Arten in Nord- und Ostsee. Zool Anz., Bd. 118, H. 1/2.

Germany.

(see also page 66).

Norway.

isheries Directorate. (Paul Bjerkan).

Sprat. Sprat investigations in the inner part of ie Oslo Fjord show that the stock is a mixture of ie- and two-year-old fish. One-year-old sprat were mparatively small and kept near the middle of ie fjord and round the islands. As the sprat were aner than usual the whole of the fjord, inside röbak, was closed for some time to the fishery for ie canning industry.

In the outer part of the fjord, between Hvaler id Dröbak, the quality in respect of both size and t was good. The June fishery was particularly good.

The vertebral number of young sprat from the slo Fjord and southern Norway was comparatively w; namely, 47·70—47·85. In the early years of rtebral counts the average number was slightly ove 48·00. This change, since 1933, is thought be connected with rather heavy spawning within e fjord at a somewhat later season than that taking ace outside.

iological Laboratory of the University and the Society for the Advancement of the Fisheries in Oslo Fjord. (Johan T. Ruud).

During summer, 1937, a cruise was undertaken th the M/C "Morild" to test the Otto Pettersson ttom-sampler on the prawn grounds. Eventually new sampler, more suitable for the purpose, was nstructed, which took a larger area of the upper ver of the sea bed, without disturbing layers or rface, and to obtain a sample of the water imme-ately above the sea bed. The instrument has been scribed in Hvalrådets Skr. No. 17 (A Bottom-mpler for the Mud-Line. In press.).

Cod. In the inner Oslo Fjord a number of cod were arked on 15th May, 22nd October, and 15th De-mber. The marks used were, partly, Lea's cellu-id holder enclosing a notice, and partly the ordinary ver disks. All marks were fixed at position D_2.

Plankton. The Plankton collected during 1933—34, d the data on the cod stock of the Oslo Fjord are present being examined in the Laboratory.

ødevigen Hatchery. (Alf Dannevig).

Cod. *Hatching.* The winter of 1936—37 was extra-dinarily cold and the temperature of the sea water the Skagerak very low. At the surface the average mperature for February was —0·2° C. and for arch —0·5° C.

The sea water in the pump coming from a depth 15 m. was always above zero, and the temperature the spawning pond averaged + 0·4 for February d 0·7 for March. At 9 a. m. on the 12th of March, wever, the temperature in the delivery pipe was low as —1·1, and the temperature in the spawning nd was —0·6. Nevertheless, the large cod in it oked quite undisturbed. By a mistake the water vel was lowered in the pond and the temperature in one of the compartments fell to —1·10°, and 14 out of the 77 cod died. The temperature was then artificially raised to —0·85 by noon, and at 1 p. m. was —0·45.

The death of the cod confirms the conclusion reached in earlier experiments, namely, that the critical temperature for cod is about —1·0° (Alf Dannevig "The Propagation of our Common Fishes during the Cold Winter 1924").

It will be understood that the conditions for the cod hatchery were distinctly adverse. It was very difficult to keep cod alive for the hatching pond, and the cod would not spawn. A few millions of eggs were spawned before 23rd March but did not develop, the greater part of them being unfertilized. On 10th April 55 % of the eggs were unfertilized, the temperature at that time being 2·6°. The normal spawning temperature for cod was not reached till the end of April. From the 16th to the 30th of that month the temperatures ranged between 3·0 and 4·7° in the pond. Even after the temperature had risen high enough the results as regarded both spawning and the quality of the eggs were very poor. To this extent the hatchery was a failure, but advantage was taken of the opportunity to study the effect of the cold water on the propagation of the cod.

Marking. On the 11th of January 80 cod two and three years old were marked and liberated near Flødevigen. During the year 35 of the fish were recaptured, mostly from the same locality. On the 18—19th of May 100 cod, most of which were apparently 3 years of age, were liberated. The recapture up to December 31st is 17. In these experiments the marking was done by R. Løversen, Assistant at the Hatchery.

Lobster. This year we succeeded in getting plenty of berried lobsters. In all, 715 were used for the hatchery. This number, however, appeared to be beyond the capacity of our apparatus, especially as most of the eggs hatched within a short period. The fry collected amounted to approximately 600,000, but 75,000 had to be put directly into the sea owing to an insufficiency of rearing boxes. From the remaining 525,000, 62,500 were reared to the fourth or the bottom stage, some being brought to the fifth stage. At the end of the rearing season approximately 4000 were liberated in the third stage. The lobsterlings were liberated near Arendal and near Kragerø.

Marking has been continued this year on Lista, west of the Naze. In the first season two experiments here gave very divergent results as to the percentage of recapture, that in the southern part gave 36 % and in the northern part 10 %.

Hydrography, Plankton and Eggs. During the year 180 hydrographical stations were made in the Oslo Fjord and along our Skagerak coast. 225 hauls with the egg net were made and 104 hauls with our large net. The eggs and larvae collected were identified by E. Sivertsen, M. A., and the students Gunnar Dannevig and Niels Brusli, under the supervision of Alf Dannevig.

The annual investigations in September with a fine-meshed seine in the littoral region showed that the quantity of the 0-group of cod was very low, though a little better than in 1936 when we had an absolute minimum.

Publications.

Alf Dannevig and Gunnar Dannevig, "The Season in which 'Winter' Zones in the Scales of Trout from Southern Norway are formed." Journ. du Conseil, XII, p. 192.

Erling Sivertsen, "Torskens gytning, undersøkelser 1934—35."

Trygve Brårud and Johan T. Ruud, "The hydrographic Conditions and the Aeration of the Oslo Fjord 1933—34." Hvalrådets Skr. No. 15.

far south even as the southern Scania coast, although in very small numbers; on the east coast of Scania, however, the 0-group was not observed.

During March the plaice stock of the southern Baltic was investigated; 47 to 61 % of the catch proved to belong to the rich 1934 year-class, with an average length of 22 cm.

This year again, transplantations (375,000 individuals) were made from the banks off the west coast of Jutland, some to Bohuslän and southern Kattegat waters, and some to the southern Baltic.

Flounder. Investigations similar to those on plaice were carried out with the flounder. The occurrence of various groups will be seen from the following table :—

Comparison of Catches per 30-min. Haul along the Swedish S. and SE. Coast.

	1935					1936					1937				
Group	0	I	II	III	IV	0	I	II	III	IV	0	I	II	III	IV
Skanör	22	12	6	—	—	15	7	8	1	—	74	26	7	1	—
Kämpinge	6	9	14	—	—	5	5	7	—	—	205	27	4	1	—
Östra Torp (St. Bedinge)	13	4	4	4	—	12	2	5	13	5	273	10	1	—	—
Ystad, harbour	—	—	-	-	-	—	—	5	10	—	141	21	—	—	—
— east of harbour	5	20	20	3	—	6	—	12	6	6	1560	36	2	—	—
— Saltsjøb.	13	13	—	4	—	4	—	—	1	—	31	1	—	—	—
Örnehusen	—	—	—	—	—	9	31	12	2	1	153	35	—	—	—
Kivik	1	4	18	2	—	15	97	10	1	—	159	12	8	14	6
Stockbacken	5	3	11	1	—	1	5	8	—	—	35	11	4	1	—
Southern Helge River	3	6	5	—	-	8	6	6	—	—	11	4	3	1	—
Northern — —	-	—	—	—	-	1	1	10	3	—	4	—	5	—	-
Yngsjö	—	—	4	—	—	9	10	26	12	—	80	19	3	—	—
Hörvik	45	36	28	4	—	382	144	102	23	—	428	39	19	—	—
Karlshamn	—	38	107	—	—	145	185	260	75	—	367	139	4	4	—

Sweden.

Biology. (Dr. K. A. Andersson.)

Haddock. The collection of statistics relating to landings at Göteborg market has been continued.

During the early half of June, 1937, an investigation into the pelagic fry was made in the Skagerak and Kattegat. At some 30 stations (see Fig. 5) oblique hauls were made between bottom and surface with the 2-m. ring-trawl. Haddock fry were very scarce, as will be noticed from the chart, only one station showing more than 10 individuals per haul. All stations in the Kattegat gave negative results.

Lemon Sole. Statistics similar to those for haddock have been collected at Göteborg fish dock.

Plaice. Figures 1 and 2 show the numbers of 0- and I-groups of plaice caught per 30-min. haul with the Johansen young-plaice trawl along the west and south coasts in autumn. The 0-group is somewhat better represented than last year, appearing as

The 0-group is considerably stronger in 1937 than in the two previous years and this year-class is to be characterized as good. Investigations into the flounder stocks in spring and autumn on the grounds north and east of Bornholm show the predominance of the IV- and V-groups (year-classes 1932 and 1933). Both of these year-classes were considered strong at the 0-group stage.

Sprat. Monthly plankton hauls inside and off the middle Bohuslän skerries, begun in 1935 for the study of variations in sprat food, were continued until November 1937. The material is now being examined.

Collection of statistics on daily landings, including information on fishing grounds, at the most important Bohuslän ports has been continued. The data have been of the greatest value in the investigation of the marked local changes of the sprat fisheries in recent years. In this connexion considerable work has been done in the course of the year, to trace possible connexions

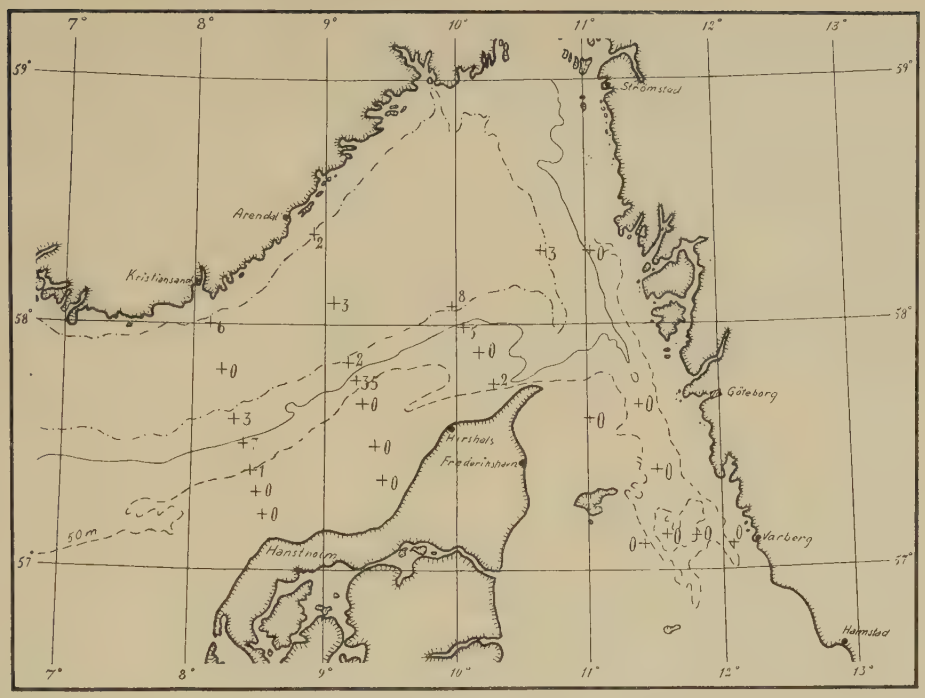


Fig. 5. Number of haddock fry taken in oblique hauls with the 2 metres stramin ring trawl in June 1937.

ween the fishery and certain hydrographic or matic factors. Dr. MOLANDER has been working nsively on the examination of the numerous data ected over several years. This examination is ring completion and a report is in preparation.

he collection of data for following the fluctuations year-classes and the composition of stocks from ious Bohuslän fjords is being continued.

Herring. In the autumn, 1936, the daily variations he vertical distribution of herring fry were studied. results were noteworthy in as much as they were trary to those obtained by A. C. JOHANSEN in the ng of 1925. It appeared that by day the herring gathered near the surface and were rather scarce deeper layers. At night, however, the greater nbers were caught near the bottom. Currents in Kattegat are so irregular, however, that conions must be drawn with caution, and it was sidered desirable to repeat the investigation ing another autumn. This was done by the end November 1937; the investigation was then nded to cover two days and two nights (October h—31st) and was combined with regular current surements and observations on submarine daylt. Weather and hydrographic conditions were er, particularly in respect of currents. Generally aking, the results corresponded with those obtained 936, a definite movement of maximum frequency pwards by day and down at night — being conied. The amplitude of vertical movement, however, was considerably smaller than the year before, and the maximum frequency was in no case observed in the surface layer. A full report on the investigations is in preparation.

Samples have been collected for age investigations.

Hydrography. (Professor HANS PETTERSSON.)

During the year a number of cruises have been carried out with the "Skagerak" when hydrographic soundings have been taken off the west coast of Sweden and within the fjords. Measurements of submarine light and transparency of the sea water have been made at different depths, and as a rule, plankton samples have also been taken. The results have emphasized the importance of transparency measurements as a simple means of locating "clouds" of suspended particles of an organic nature, plankton and detritus.

More detailed studies of the relationship between angle and intensity of incident light under water at different depths have been made from Bornö Station by means of apparatus specially designed for the purpose.

Studies of the relation between meteorological and hydrographic phenomena, and the formation and breaking up of sea ice have been started at Bornö Station.

Research on the radioactive elements present in sea water, viz. uranium, radium, radon and thorium,

has been continued from Bornö in collaboration with specialists in Vienna and Oslo. The results, proving the extreme poverty of sea water in radium content in contrast with previous measurements, are being worked up for publication. The radium content of mollusc shells *Ostraea edulis* and *Mytilus edulis* has been determined with shells of various ages, the results indicating a fall in radium content with age, corresponding approximately to the decay period of radium.

Regular observations of salinity, temperature, and currents in the coastal water at different depths have been continued from three lightships, "Svinbådan", "Fladen", and "Vinga", and salinity and temperature have also been measured regularly from the observation pier at Bornö.

Germany (Dr. Fischer.)

Flatfish. Transplantation of North Sea plaice into the Baltic was continued. Again, fish of up to 35 cm. in length were dealt with, in addition to those of 20—24 cm., and the liberations were made principally in Lübeck Bay. For purposes of comparison, Baltic plaice were marked contemporaneously with the North Sea plaice. A few recoveries of the plaice marked in 1936 showed that the growth of the transplanted North Sea plaice is more rapid than that of the Baltic plaice. In a year and a half, for example, a North Sea plaice grew by 20 cm. in length and ten times its weight at liberation, while in roughly the same time a Baltic plaice grew only 6 cm. and about doubled its weight. For the first time a few North Sea plaice were obtained which, after having lived for some two years in the Baltic, were ready to spawn.

The investigations, taken in hand last year by Dr. Krüger, on the effect of the environment (Umweltverhältnisse) on the bottom fauna and flora in Kiel Bay and in particular on the effect of the so-called infected grounds on the conditions of growth, were carried on.

Herring and Sprat. The question of local types of herring in the western Baltic was studied with regard to spring and autumn herring, according to the methods described in last year's report. The distinction between the types seems to be fairly large, as evidenced, for example, by vertebrae counts on four samples of autumn herring, then in process of spawning, taken in Kiel Bay in autumn 1937. The following figures were obtained:—

Position	Date	Number of Fish	Vert. S
Outside Kiel Fjord.....	10.IX.1937	271	55·56 ± 0·040
Fehmarnbelt Lightship ...	6. X.1937	452	55·39 ± 0·032
Maasholm.....	12. X.1937	421	55·62 ± 0·035
Hohwacht Bay	18. X.1937	369	55·50 ± 0·035

The observation of the result of the sprat fishery by otter trawl was supplemented by special investigations on the conditions and seasons of the spawning of the sprat in Kiel Bay and on the occurrence of juvenile and two-year-old sprat and herring in Mecklenburg Bay, east of Fehmarn, where there is an extensive fishery in September and October.

Eel. Study of the eel stock ended when Dr. Meyer and Dr. Krüger completed their work on the ecological conditions in Wismar Bay. The conclusion reached was that the smallness of the eels was due, not to lack of food, but to the fact that by far the greater proportion of the eels there consisted of males. It could be demonstrated that the Wismar Bay eel, when it reaches a length of 32—33 cm., has a higher fat content than eels of similar size from other waters, as for example, the Dassow See or the Greifswald Bodden.

Salmonidae. Brook trout were again set out in Wismar Bay, as in previous years. The results were better last year than in the year before. In addition, efforts were made to establish rainbow trout in Wismar Bay, with satisfactory results. Rainbow trout grow in the brackish water just as well as brook trout. The only difference is that after living one year in salt water rainbow trout keep their original appearance, while brook trout lose their typical colouring soon after liberation and resemble sea trout. Rainbow trout exhibit no difference from brook trout as regards appearance and flavour of the flesh.

BALTIC AREA COMMITTEE

1937.

By

K. A. Andersson.

The investigations in the Baltic Area during the year 1937 were continued on much the same lines as in previous years. The main work was devoted to the study of herring, sprat, plaice, flounder and cod. The cod fishery in the Bornholm area was still poor. The catches of herring along the Swedish coast during the summer were small. The hydrographic investigations have been extended to include measurements of submarine light and transparency.

The following are the reports of the work carried out by the various countries:—

Denmark.

Biology. (H. Blegvad).

Investigations were carried out from the "Biologen" and its motor-boat in the waters round Bornholm and east of Rügen.

Plaice. In the waters round Bornholm (see Fig. 1) the number of plaice of the 0-Group taken in the fishing gear was small, as was the case in the two preceding years. Fishing with the "eeltog" in the waters round Bornholm in ca. 30—90 m. depth produced very few plaice, this being in good accordance with the fact that the plaice fishery round the island has been very poor in 1937.

In the waters east of Rügen no plaice of the 0-group were caught, neither in shallow nor in deeper waters. Of the plaice caught in this area the II- and III-groups were predominant, the II-group being the most numerous; large catches of this age-group were made in the coastal waters of Prorer Wiek especially.

Flounder. The catch of the 0-group in the waters round Bornholm is depicted in Fig. 1. The 0-group was about as rich as in 1936 and considerably richer than in 1935. In Prorer Wiek (at one station) 20 fish of the 0-group were taken per $^1/_2$ hour in Johansen's young plaice trawl and 142 per fishing unit with the hand push net.

Turbot. The number of turbot of the 0-group caught in Bornholm coastal waters was somewhat below normal.

Cod. In the Bornholm waters only few cod of the 0-group were caught; the I-group was better represented. The III-group predominated among the older cod caught in the deeper waters.

Herring. Stock analyses have been carried out on herring caught west of Bornholm during the summer fishing. Among the herring those hatched during the autumn of 1934 were most numerous.

Valuations of the Sea Bottom were carried out in the waters round Bornholm and east of Rügen.

The food of the Herring. The investigations started in 1932 have been brought to an end and the following report was published:— P. Jespersen: The food of the herring in the waters round Bornholm. Medd. Komm. Danmarks Fiskeri- og Havunders., Serie Plankton, Bind III, 1936.

Finland.

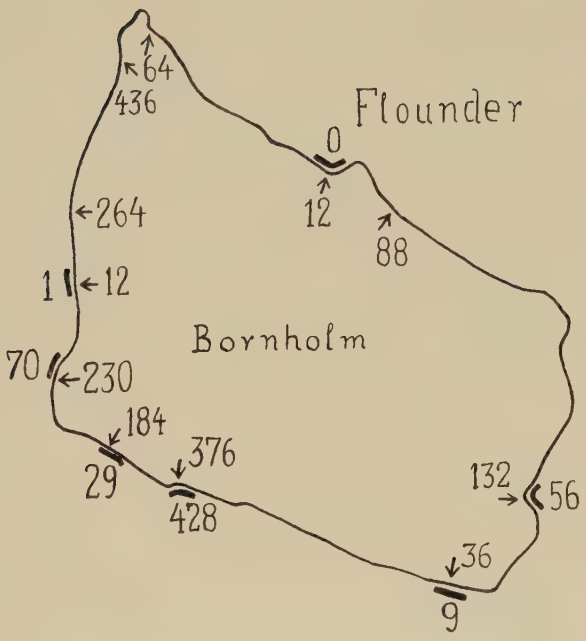
Biology. (T. H. Järvi).

Salmon scales have been collected for analysis as before (see the report of the Salmon and Trout Committee). Statistics of the seals killed in the Gulfs of Bothnia and Finland were collected.

Hydrography. (G. Granqvist).

Regular observations were made as follows:—

a) Surface temperature daily, surface salinity every 5th day, temperature and salinity at different depths every 10th day at 27 coastal stations and 9 lightships.



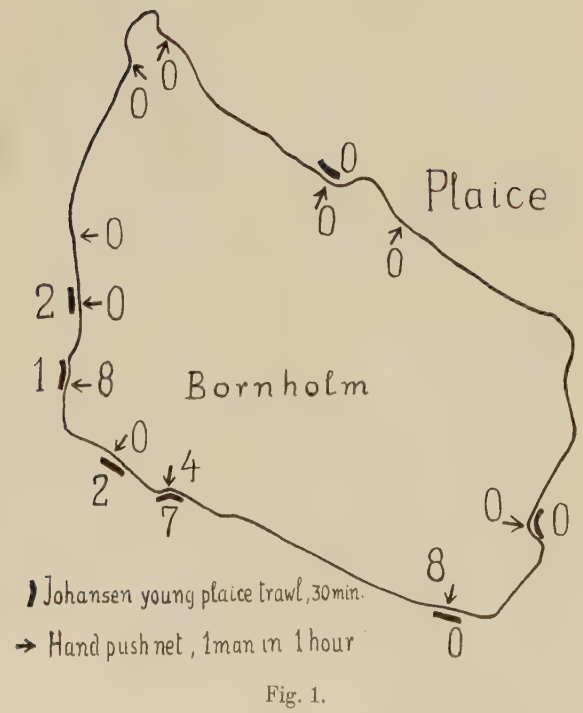


Fig. 1.

b) Surface temperature and salinity by liners from Finland to Denmark.
c) Currents at three depths thrice daily at 9 lightships.
d) Registration of the sea level at 17 stations and readings of the sea level at 20 stations.
e) Records of ice conditions from journals and sketch-maps at about 100 stations and by all Finnish ships in the Baltic.

Germany.

(see page 71).

Latvia.

Statistics. (V. Miezis).

The Board of Fisheries and Pisciculture (Ministry of Agriculture) continued statistical work on sea fisheries as in former years. The *Bulletin statistique des pêches maritimes de Lettonie*, année 1935, has been published. The statistical data for 1936 will be published shortly.

Biology.

The Fishery Laboratory (Ministry of Agriculture) continued the investigations of Salmonidae through marking experiments, and age and growth determinations. Experiments in rearing young salmon in the ponds of the Government's hatcheries were also continued. The investigations on the flounder, herring, and sprat of the Latvian coasts were continued and extended.

The Hydrobiological Station of the Latvian University (Director, Prof. Dr. Embrik Strand) continued its researches on the plankton and the fish of the Latvian coastal waters and the Gulf of Riga.

Hydrography.

The Fishery Laboratory (Ministry of Agriculture) undertook two hydrographical cruises in the Baltic from 20th May to 4th June and from 8th to 23rd October. On each cruise observations were made at 11 positions in the Gulf of Riga and at 5 positions in the Baltic proper, including determinations of temperature, salinity, oxygen, hydrogen-ion concentration, alkalinity, phosphate and nitrogen compounds. The same methods were used as in previous years, and the data have been published in the *Bulletin Hydrographique*.

The Hydrobiological Station of the Latvian University (Director, Prof. Dr. Embrik Strand) undertook regular surface observations of t° and $S^0/_{00}$ as in previous years. The observations have been or will be published in the *Bulletin Hydrographique* and in the *Folia Zoologica et Hydrobiologica*.

The Marine Department of the Ministry of Finance continued water-level observations at 10 stations along the Latvian coasts. The results of these observations have been sent to the Hydrographical Service and published in part in the *Bulletin Hydrographique*.

Measurements of sea-current direction and velocity different depths were continued by the Department, in former years, from the lightship at Ovizi.
Hydrographical measurements were continued on e coast of the Baltic from Ventspils to Ovizi and the Gulf of Riga from Riga northward to Skulte.
The Marine Department issued the following aper:— "Sea-Ice conditions at the coast of Latvia uring the Winter 1936/37", Riga, 1937.

Poland.

iological Studies. (M. Siedlecki).

A new supplementary list of marine animals found f the Polish coast, containing 26 species not hitherto corded from that part of the Baltic, was published *Archives d'Hydrobiologie et des Pêches* Vol. X. This rk is being continued. *Priapulus caudatus*, taken the deeper part of the Gulf of Danzig, was among e newly found animals.
Studies of the seasonal variation of the composition the fauna near Hel Peninsula were continued and e results will be published in 1938.
Studies of the free-living infusoria and the parasites fishes were continued. Work was undertaken on e comparative anatomy of fishes and some results re published in *Zeitschrift für Anatomie und Entcklungsgeschichte* Vol. 107.
Botanical studies of the Polish coastal flora were ntinued. A list of algae not planktonic was pubhed in the Bull. de la Stat. Marit. de Hel No. 2 — 37. The genus *Desmotrichum* was especially studied d a reduction of the number of species belonging that genus resulted from this study.
Endophytic plants living on the sea grass *Zostera*, particular, the variety *Endoderma perforans*, were idied both in the plants and in artificial cultures.

sheries Investigations.

Sprat. The sprat fishery, which has developed idly since 1930, showed a considerable decrease t season (1936/37). The total yield of the fishery from 15,000 tons in a season to about 3,000 tons.
e sprat shoals did not appear on the ordinary hing grounds in the Gulf of Danzig in the 1936/37 ason, as was also the case in the 1937/38 season.
The studies of the hydrographic conditions during e last two seasons, undertaken in connexion with e study of the distribution of sprat shoals in the lf of Danzig, seem to indicate that the times and ces of appearance and the migrations of sprat pa's are very susceptible to unfavourable tempera- re and other hydrographic conditions. Research on logical factors, doubtless also of great importance, s not sufficiently far advanced to allow conclusions be drawn, but is now being actively prosecuted.
The studies on the composition of sprat shoals were dertaken in the first part of the season 1936/37 m December to February, but their continuation s prevented by unfavourable weather conditions. 155 fish from 7 catches were examined. The average composition of the shoals, as indicated by the percentages of the several age-groups, was as follows:—

Season	$3^1/_2$ years	4 years	5 years
1936/37.....	16·5 %	60 %	21 %

In comparison with 1935/36, when the $3^1/_2$-year-group amounted to 33 % of the fish in a catch, this young group was scarce in the 1936/37 season. Further investigations on this matter are in progress.

The feeding of sprat on the Polish coast was studied. It was found that feeding depends chiefly on the temperature of the water, the least food being taken in winter and the most in late summer. Neither the age, sex, nor state of development of genital products have any influence upon feeding. In every season of the year there are periods of fast and of intensive feeding. In winter the fasting periods extend over a number of weeks and food is taken only for a few days between the fasting periods. In spring and autumn both periods are short and alternate quickly. The food of adult sprats consists chiefly of copepods but depends on the local and seasonal composition of the plankton.

Studies of the feeding of the larval and young sprat are in progress.

Herring. Data for the investigation of the herring shoals in the Gulf of Danzig were collected and studies were prosecuted on the rate of growth, onset of sexual maturity, seasonal changes in fat content, composition of commercial catches and variation of the number of vertebrae.

The small herring peculiar to the Baltic (*Clupea harengus* var. *membras* — called "Strömling") was studied on an expedition of the research vessel "Ewa" to the Latvian waters. It was established that this variety was to be found only in the Gulf of Riga and near Vindau, the herrings from the neighbourhood of Liepaia showing the characteristics of the spring-spawning race of herring from the more southern parts of the Baltic.

Flounder. The development of the genital products in flounders from the Gulf of Danzig was studied. The main results may be summarized as follows:—

The development of the gonads begins in September while the flounders are still in shallow water. They gradually migrate towards the deepest parts of the Gulf of Danzig where, from March till early June, spawning occurs. The spawning fish belong to the age-groups from III to VIII, the most numerous being the V-group (40·5 %). The average length of these is less than the average length of spawners from Bornholm waters. The males are, on an average, about twice as numerous as the females.

The studies of the racial characters of flounders in the Gulf of Danzig were continued. An analysis of 2,760 vertebral columns from flounders proved that flounders from the various parts of the Polish waters and of the Gulf of Danzig belong to one local race.

Marking experiments with flounders were continued. The results will be published in Arch. d'Hydrobiol. et des Pêches.

The hydrographic research, as well as that on plankton and salmonid fishes, is described in the reports of the respective Committees.

Towards the end of 1938 the marine station now located at Hel will be transferred to Gdynia, where a new building containing an aquarium is under construction.

Sweden.

A new motor-boat named "Eystrasalt", which has been built for fishery investigations, was kept in commission during the period 1st July to 5th November.

The research vessel "Skagerak" made three voyages to the Baltic, in March, May, and September.

Biology.

Cod. The investigations at sea were mainly devoted to the study of the stock of cod from the Bornholm area in the south to the coast off Stockholm in the north. The cod were still very plentiful in the Bornholm region and yielded very good catches in this region in deep water, but they were less abundant to the north along the Swedish continental coast. In the deep water to the east of Landsort the stock was poor, but off the eastern coast of Gothland the catches were fairly good.

In the Bornholm region the cod were large but on an average their size diminished towards the north. Samples from all of these areas were collected for the study of the age composition.

Three cod marking experiments were carried out during the year, as follows:—

1) Bornholm region in July; 200 fish,
2) Southern part of Kalmar Sound in July and August; 152 fish,
3) East coast of Gothland in August; 142 fish.

By the end of the year, the returns from the three experiments were 23, 11 and 18 respectively. One recapture from Experiment 1) was found to have migrated from the west coast of Bornholm across the deep water to Rügenwalde on the German coast, a distance of approximately 70 miles, in the course of 90 days. Most of the other fish recovered had travelled only short distances.

Herring. In the year previous to that now under discussion the herring fishery had been very rich and was based upon the 1929 and 1930 year-classes of autumn and spring spawning herring respectively. During the summer of 1937 the catches of herring were very small along the east coast of Sweden. The year-classes referred to, which supported a very rich fishing in 1936, had by this time grown fairly old, and it is likely that they are very nearly exhausted. In the autumn and winter a new year-class, from the year 1934, appeared in the catches. Samples of herring from different parts of the Swedish coast were collected and examined as to length, maturity, and age composition.

Flounder. The abundance of the 0-group of the flounder was investigated at a great number of stations in shallow water along the coast of Scania and Blekinge. The 1937 year-class seems to be more numerous than was its predecessor.

Sprat. Fishing experiments were carried out in different parts of the area in order to study the stock of sprat. As a rule the catches were small.

Hydrographical observations were made in connexion with the biological investigations at all stations, temperature, salinity and, at a few stations, oxygen content being determined.

Hydrography. (H. Pettersson).

From 5th to 25th May the "Skagerak" carried out a hydrographic cruise in the Baltic; hydrographic soundings, submarine light and transparency measurements, and observations of the current at different depths were made partly along sections from Ölands Rev to Libau and between the south cape of Gothland and the two points mentioned, partly at selected points near Ölands Rev. The observations were supplemented by similar measurements from the "Ölands Rev" lightship. The purpose of the cruise was the study of the penetration of solar heat into the surface layers of the Baltic and its effect on the water temperature. The work was planned and undertaken in collaboration of Dr. Anders Ångström, Chief Climatologist to Statens Meteorologisk Hydrografiska Anstalt in Stockholm. This institution provided instruments on loan for measurements of solar radiation, humidity, and temperature, which were carried out from the lighthouse on the southern promontory of Öland.

A preliminary survey of the data, which are being worked up for publication, indicates that surprisingly large differences in temperature occur at the same depth at positions a few kilometres apart. The importance of the horizontal currents for distributing the effect of insolation is emphasized by these results. The considerable effect of warm air currents from the shore in raising the temperature of the surface layer is also apparent.

Transparency measurements carried out down to depths of 80 metres in Bornholm Deep proved the homohaline upper layers, down to about 60 metres, to be of fairly homogeneous transparency, whereas considerable changes were found near the density gradient.

A repetition of the cruise, from 20th to 30th August, proved that owing to continuous reception of solar heat during the intervening months, the thermocline occurred at a considerably higher level in the central part of the Baltic than near the shores, where regular observation of water temperature is carried out from lightships. This finding, which agrees with the general horizontal circulation ascribed to the surface in the Baltic, makes it necessary to use considerable caution in drawing inferences on the storage of heat in the Baltic from light observations. The investigation will be repeated in May 1938 with improved equipment for the meteorological part of the programme.

Germany. (E. Fischer).

at Fish.

The investigations into the landings of flat fish have en continued. Dr. Altnöder and Dr. Maier have ch written a report on the results of the statistics recent years; the reports will be published during s year.

Special attention was given to the rich 1934 year-ss of plaice. The appearance of this in the fishery, d its growth and development to maturity was sely followed by means of statistical market in-stigations, marking experiments and by voyages board cutters.

The work on turbot has been continued, but pro-eds very slowly, due to the scarcity of material.

d.

A detailed survey of the stock of cod present in e German fishery precincts was carried out during February and March on voyages by cutters from Kiel to East-Prussia. About 1000 cod were marked.

Eel.

The question of the influence of light and moon phases on the migration of the silver eel has been studied for some years on the east coast of Rügen, the chief place of capture during migrations. The results of these studies show that it is not the influence of light alone which determines migrations and catch, but that cosmic influences must be assumed to act. Dr. Maier's observations carried out since 1931 will be published shortly in the *Zeitschrift für Fischerei.*

In conjunction with these studies a new method for marking eels was developed. The eels were stunned by an electric apparatus, "Narkostat", devised by the firm of Siemens. The stunning by the electric current does not injure the eel appreciably.

Reports of other Committees.

HYDROGRAPHICAL COMMITTEE

1937.

Prof. Martin Knudsen.

Belgium.

No special report has been received, but the hydrographical work has been reported in the Combined North Sea and Eastern Channel Committee and in the Southern North Sea Committee reports.

Denmark (by Prof. Martin Knudsen).

North Western Area.

Of the four permanent sections at Iceland only two have been run (by Icelandic patrol cruisers) in the following months:

Langanes: June, September, November.
Kögr: May, September, November.

At West Greenland the three permanent sections (cfr. Rapp. et Proc.-Verb. XCIV, 2°, p. 64) have been run by the survey-ship "Hejmdal" as follows:

Fylla Bank: June, August.
Lille Hellefiskbank: June, August.
Store Hellefiskbank: June, August.

Surface observations of temperature and salinity have been continued from liners to Iceland and Greenland.

An investigation of temperature and salinity of the surface water of Icelandic fiords during one year from coastal liners has been completed.

Southern North Sea.

Surface observations of temperature and salinity have been collected from the line Esbjerg—Harwich as in previous years.

Daily observations of temperature and salinity (with hydrometer) from the lightships "Horns Rev" and "Vyl" have been undertaken by the Danish Meteorological Institute as in previous years.

Transition Area.

Observations of temperature and salinity, and at a few stations of oxygen also, have been carried out from the "Biologen" in close connexion with the biological investigations, mainly during the months April, May, and October. All observations except those from Limfjorden will be published in the *Bulletin Hydrographique*.

By the Danish Meteorological Institute regular hydrographical observations have been carried out as follows:—

1) Daily observations of temperature and salinity (by hydrometer) from 10 lightships and from 17 coastal stations.
2) 4-hourly observations of the surface current at 10 lightships.

Baltic Area.

At the surface at Christiansø near Bornholm the Danish Meteorological Institute has made daily observations of temperature and salinity (by hydrometer).

England.

S. North Sea and Channel.

(Report by J. N. Carruthers.)

During 1937 the Drift-Indicator work from the "Varne" lightship continued without a break as

ing the previous eleven years. The present wooden tship at the "Varne" will have been withdrawn the time this report is in print, and, following substitution for it of a large steel vessel, a Vertical current meter will have been installed in the e of the Drift-Indicator. Aboard the "Cromer ll" and "Royal Sovereign" lightvessels, Vertical s have been working without intermission ughout the whole year.

he winther programme of continuous current suring aboard the "Galloper" and "Sandettié" tships[1]) embracing the months of December, uary and February (1937/38) has been repeated. s work was also carried out by Vertical Logs and , as before, in connexion with a plankton-col- ng campaign.

outine work with ordinary surface-floating drift- les has again been restricted to weekly liberations the "Smith's Knoll" lightvessel, but a number xperiments with bottle systems which stay afloat for a time have been made in connexion with ial problems of herring larvae dispersal.

s regards the flow through the Straits of Dover, again clear that there was a less bold flow than ng the previous year.

hereas, during 1936, there was a bold flow during four months of January, July, November and mber — followed by March and September, in year 1937 only the months of January and ruary witnessed a strong flow towards a point of NNE. December follows in importance.

uring the other nine months it seems that very water can have traversed the Straits into the h Sea, and from May to November there was ably less flow than during any series of months raced by the observations.

(Report by J. R. Lumby.)

e routine surface observations of salinity and erature from lightships and merchant vessels continued unchanged. Samples at an additional ion — towards the French coast — were taken he Newhaven—Dieppe line during the herring g season.

linity and temperature observations were made the "George Bligh" on twelve cruises, in January, uary, April, May, June, July, August, October November (2), and December, in connexion with e egg and plankton studies. Oxygen samples taken on the cruises in January, February, , July, and October (2), and phosphate analyses made in April, May, August, October, and ber. In August, observations were made on olour and transparency of the water.

e "Onaway" made salinity and temperature vations on the Flamborough line in January, h, April, and May.

e salinity and oxygen samples were analysed

Once again acknowledgement is made of the kind eration on the part of the Office Scientifique et nique des Pêches Maritimes.

at the Government Laboratory, and the phosphate was estimated on board.

Esthonia.

Hydr. observations have been received as usual from 9/VII to 10/VIII; the data will be inserted in the *Bulletin Hydrographique.*

Finland.

For the first time over a long series of years the "Nautilus" has not been available for hydrographical work in 1937. The rest of the ordinary programme has been carried out as in previous years.

France.

No special report received; the work is briefly reported in the administrative report of the Atlantic Slope Committee. (p. 20).

Germany (by Prof. B. Schulz).

General.

The regular observations carried out by the "Deutsche Seewarte" from the German lightships were continued on the larger scale described in the Report for 1936 (Rapp. et Proc.-Verb. No. 105, II, p. 66). All observations made in 1936 have been published in No. 12 of the series "Meereskundliche Beobachtungen auf den deutschen Feuerschiffen der Nord- und Ostsee", which appeared in September 1937. The size of this number has considerably increased since the current and wind observations which are now taken every second hour are all published. The observations from the lightships "Kiel" and "Flensburg" started on 1st July 1936 have also been published. The intensification of observations on all Baltic lightships since 1st November 1936 (current observations six times daily instead of three times, and hydrographical series with depth intervals of 5 m.) has worked very well, but the November and December results 1936 were considered as trials only, and the complete data are published as from 1st January 1937. The regular collection of salinity and temperature data on the lines Hamburg—New York and Sassnitz—Trelleborg has been continued as hitherto.

Baltic.

In the Bornholm basin a fine net-work of stations was covered during a cruise of the R.F.S. "Poseidon" on 4th to 24th September. At a fairly large number of stations north and north-east of Bornholm the series were repeated once and occasionally even twice with a week's interval, so that all changes due to time and the varying weather conditions could be taken into account. To the north-east and east the series were extended to the northernmost part of the western Gothland basin and to the Danzig trough. A total of 86 series was worked. The hydro-

graphical observations were made by Prof. Schulz, Drs. K. Kalle, E. Goedecke, O. Hatje, Scheepers, and Mertins. The plankton investigations made at the same time were carried out by Profs. Hentschel and Brandes, the eggnet catches by Dr. Kändler, and an opportunity was accordingly given for studying the relations between the hydrographical and biological factors.

North-Eastern Area.

In the southern Barents Sea fishery biological and hydrographic observations were made from 30th September to 24th October during a cruise of the trawler "J. H. Wilhelms" (Wesermünde), chartered for the occasion. 36 hydrographical series were made mainly in the 5 following sections:—

1) Vardö—Northern Deep
2) Cape Kanin—Northern Deep
3) Cape Kanin—Mouth of the Petchora
4) Kolgujew—Goosebank
5) Northern Deep—Goosebank.

Observer: Dr. E. Goedecke.

Transition Area.

Research cruises were carried out in August and December 1937 in Kiel Bay by the Fishery Inspector's boat "Heinrich Schnoor" for the "Institut für Meereskunde" of the Kiel University. It is intended that these investigations should extend over a long period, in order to provide material for a survey of the hydrographic and chemical conditions in the western Baltic. They comprise 25 stations at which water samples were taken at depths of 5 m. intervals. Besides temperature and salinity, phosphate, silicate, nitrite, nitrate, opacity, and yellow colour of water were determined, and oxygen, hydrogen-ion-concentration, alkalinity, and calcium were measured at 5 m. depth and near the bottom. Kiel Fjord and Eckernförde Bay were examined in the same way, but with much smaller intervals, in space as well as time. In Eckernförde Bay 17 stations were made every 2 months, in Kiel Fjord 24 stations every 3 weeks. Dr. H. Wattenberg, Dr. Helga Meyer, and Dr. K. Krüger were the observers.

Holland (by P. M. van Riel).

Southern North Sea.

The customary surface observations of temperature and salinity from liners and light-ships in the Southern North Sea have been continued without change. During October and November surface samples were collected by H.M.S. "Nautilus" on sections between 52°30′ N. and the line Dover—Calais.

Since July 1st 1937 continuous surface current observations have been carried out by the Rijkswaterstaat with the "vertical log" aboard lightship "Maas". (See Journ. du Conseil, Vol. XII, No. 3, 1937, p. 335).

North-Western Area.

During May and June H.M.S. "Nautilus" made a cruise towards Iceland. Temperature and salinity observations were carried out by Dr. Tesch at all permanent hydrographic "Dana"-stations in the vicinity of the Faroes and Iceland at depths of 0, 25, 50, and 100 m.

Northern North Sea.

Similar observations were carried out by Dr. Tesch on a vertical cross-section (9 stations) between the Orkneys and Utsire.

All samples were titrated at the Fishery Institute at Den Helder. The temperature corrections for samples from lower layers were applied at de Bilt.

Ireland (Éire) (by G. P. Farran).

The customary hydrographic cruises of the s.s. "Muirchu", with temperature and salinity observations, took place on the north coast of Ireland in February, May and August, 1937.

Latvia.

(See the Baltic Area Report on p. 67.)

Norway.

(See the North-Eastern Area Report on p. 7)

Poland.

Baltic Area.

The programme of the work was continued without change.

1) The Marine Station at Hel collected monthly hydrographical observations at different depths (salinity, temperature, oxygen, phosphate, nitrate and pH) at 12 fixed stations in the Gulf of Danzig.
2) The Meteorological Institute has carried out regular observations as follows:
   (a) Daily observations of temperature and salinity at 3 coast stations.
   (b) Surface temperature and salinity made from liners between Gdynia—Kattegat and Gdynia —Gäfle, twice monthly.
   (c) Current-observations by means of surface drift-bottles liberated from the steamers mentioned above (b).
   (d) Registration of the sea level at 1 station and reading of the sea level at 2 stations.

All the data collected are forwarded to Copenhagen for inclusion in the *Bulletin Hydrographique*.

A paper by Mr. Kijowski "Some data about the chemical composition of the water in the Gulf of Danzig" was published in the *Bulletin of the Marine Station at Hel.*

Portugal (by Dr. A. Ramalho).

n continuation du plan de recherches entreprises
uis la fin 1936, l'"Albacora" a fait sept croisières
s la baie au large de l'embouchure du fleuve
e, aux mois de Février, Avril, Mai, Juin, Août,
embre et Décembre (comprenant au total 211
ions) et des observations dans l'estuaire du Tage
mois de Novembre (12 stations), à l'occasion
e crue anormale de ce fleuve.
matériel d'observation (température, salinité,
gène, phosphates) sera communiqué sous peu de
os au Service Hydrographique en vue de sa
ication éventuelle.
n rapport sur les résultats de ces travaux, après
s soient terminés, sera communiqué ultérieure-
t.
navire "Albacora", qui était affectée aux
ces de la Marine de Guerre, a été remis à la
tion et à l'administration directe de la Station
iologie Maritime de Lisbonne (Aquário Vasco da
a), au mois d'Octobre 1937; il va être soumis à
réparations générales; un sondeur enregistrateur
-sonore, type "Challenger", sera installé à cette
ion.

Scotland (by Dr. John B. Tait).

drographical investigation during 1937 followed
lines of previous years. Throughout the period
Explorer"'s commission, that is, from March until
mber inclusive, 310 hydrographic stations were
pied in the Northern and Middle North Sea, the
e—Shetland Channel, including Faroe, Faroe Bank
Wyville Thomson Ridge areas, and in the west
tish waters within and beyond the Hebrides. A
of 2275 temperature observations were made
spect of surface, intermediate and bottom waters,
a like number of sea water samples collected for
ity determinations. These data will eventually
ar in the appropriate annual *Bulletin Hydro-
nique*.
r the direct investigation of currents, ten surface
-bottles were liberated at each of 260 selected
ions in the above-mentioned areas. The remarkably low return of only 20 per cent. of these bottles is recorded to date, liberations at no fewer than 89 stations, 80 of which lay within North Sea limits, having so far yielded no result.

This circumstance, in conjunction with various other factors, points conclusively to the fact of a much weaker inflow of Atlantic water into the Northern North Sea during 1937 than has been experienced for at least five years. At the same time it is clear that, although the intensity of the oceanic impulse was relatively weak, the inherent properties of the water comprising it, particularly its salinity, were still above the average, less so on the whole than during 1936, but sufficiently marked to enhance the inference put forward in 1934, to the effect that, during the present decade, and superimposed upon its well-known seasonal variation, the intensity of the Atlantic inflow into the Northern North Sea is undergoing a long-period cycle of changes.

Further of import as regards the oceanic incursion of 1937 was the obvious lateness of its period of maximum seasonal activity, which appears to have been reached only in the month of August instead of, as in most years, during April or between April and May.

On the basis of these, the most outstanding hydrographical features of 1937, the leading details of other observations for the year receive satisfactory explanation.

Thus, during 1937, there was direct evidence of three distinctive types of water in the Northern Area, (I) Atlantic water, (II) Northern water from the north and north-west of Faroe and (III) Continental water from the Baltic regions principally.

Spain.

(No report received due to the existing difficulties in Spain.)

Sweden.

(See Baltic Area and Transition Area Reports on pp. 57—71.)

PLANKTON COMMITTEE

1937.

Prof. H. H. Gran.

Belgium.

No report received.

Denmark.

I. Home waters.

1. Dr. Steemann Nielsen has continued the examination of the phytoplankton water samples collected in 1935 and 1936 from boats on the routes Oslo—Copenhagen, Odense—Copenhagen, and Rønne—Copenhagen. The object of the investigation is the survey of the phytoplankton production in Danish waters.

2. An apparatus for determining the transparency of water samples has been constructed by Dr. Steemann Nielsen.

3. The weekly collection of plankton from three lightships in Danish waters has been continued. Continuous collections have been made since 1929.

II. Northern waters.

1. Dr. Jespersen has finished his investigations on the marine copepod fauna in East Greenland fjords and Denmark Strait. The material was collected partly on the cruises of the research vessel "Godthaab" in East Greenland waters in 1932 and 1933, and partly on the cruises of the "Dana" in Denmark Strait and along the East Greenland coast in 1931 to 1933. A report dealing with the biology and distribution of the various species of copepods is ready for publication.

2. Prof. Ove Paulsen has continued the examination of microplankton collections from Iceland waters, Dr. P. Jespersen those of the macroplankton, both from the biological and geographical standpoints.

3. Dr. Jespersen has undertaken an investigation into the size variations of the copepod *Calanus hyperboreus* in West Greenland waters. A single size-group only was found, but taking the average size for material from various parts of the waters west of Greenland it can be shown that the smallest sizes of this copepod are found in waters mixed with Atlantic water of temperature above 3° C., while the larger sizes predominate in water with negative temperatures and up to 1—2° C. (1).

4. A systematic account of the marine copepods of East Greenland has been prepared by Dr. Jespersen for publication in "The Zoology of East Greenland" (published in "Meddelelser om Grønland"). Only the copepods found within the 1,000 m. line are dealt with in the report, giving a total of 81 species known from East Greenland up to the present. Of these, 35 species belong to the sub-order Calanoida, 27 species to the Harpacticoida, and 8 species to the Cyclopoida, the rest being mostly parasitic forms. In particular the paper gives the distribution of the various species in East Greenland waters, with notes on further distribution.

5. The examination of the material from the cruise of the M/C "Thor" to the west and south of Iceland in 1935 has been continued. Two reports have been published (2 and 3).

6. Water samples for the quantitative determination of phytoplankton on the south coast of Iceland were collected in the spring of 1937 from the mail-steamer "Island". These samples were unfortunately lost when the ship was wrecked on the Scottish coast in April. The collections will be continued.

III. Publications.

1. Jespersen, P., "On the Size of *Calanus hyperboreus* Krøyer in West Greenland Waters." Int. Rev. ges. Hydrobiol. und Hydrographie, Bd. 34. 1937.
2. Steemann Nielsen, E., "Undersøgelser over Stofproduktionen i Havet ved Island." Publikationer om Ostgrønland, No. 5. 1937.
3. — "On the Relation between the Quantities of Phytoplankton and Zooplankton in the Sea." Journ. du Conseil, Vol. XII, No. 2. 1937.

England.

Lowestoft.

Nine plankton cruises of the research steamer "George Bligh" and eight short cruises of the motor drifter "Onaway" were made during 1937, as follows:—

. Investigations on the ether-soluble matter of d plankton (a) along the English east coast area ne and October), (b) monthly observations at six ions between Flamborough Head and the south- t patch of the Dogger Bank (January to Decem-).

. Plankton of the northern grounds. Three parallel s of stations across the North Sea, the northern- t line crossing from off the Northumberland coast ff the Naze (May).

. Investigations into the relation between abun- ce of plankton and the hydrological conditions ril and August).

The relation between phytoplankton concentra- s and the autumn shoaling of herring off East lia (October, November and December).

he six routine Hensen net stations worked each th between Flamborough Head and the Dogger k, together with the two cruises covering the off the English east-coast, which have now n made regularly since 1932, were continued in 7. The specific composition of plankton from these s has been characterized by the abundance and nt of *Rhizosolenia styliformis* which was found he Flamborough area through the greater part he year. The ether-soluble matter content of hes parallel to those taken for biological estimate higher in the northern part of the June cruise n for any other comparable period during the s investigated. At one station, consisting almost rely of *Calanus finmarchicus*, the ether-soluble ter was over 40 % of the dry weight. On the Oc- r cruise these values were rather higher than the age.

nalysis of Phosphate. In April phosphate was d to be low in the southern North Sea, except off estoft and off the River Thames. The English nnel was also characterized by low values except he Isle of Wight, where moderate values were d. There was a fair growth of *Phaeocystis* in the hern Bight. In August, when *Rhizosolenia styli- is* was found in small quantity, most of the hern North Sea was poorly supplied with phos- e, but there was a patch of richer water on the ger Bank and another extending from the Thames uary, although not so far to seaward as in previous s. Colour of water and transparency were ob- ed on this cruise by three different methods, and as easy thus to distinguish coastal from more nic water. *Rhizosolenia* was near the northern, oceanic, water.

he following paper is ready for publication: "On Occurrence and Nutrition of Microscopic Plants harm the Herring Fishery of the Southern h Sea".

he usual autumn survey of phytoplankton con- rations in the Southern North Sea was carried during October, November and the first half of mber. In early October the diatoms *Rhizosolenia formis* and *Biddulphia sinensis* were found in dense patches which overlapped more than usual. These concentrations were situated between 53°30′ N. and 54°30′ N. Lat., and 0°30′ E. to 3°30′ E. Long., covering an area of over 6,000 square miles. Towards the end of October both patches of diatoms had increased in density and extent, but had drifted some 30 miles to the east and north-east. During November both concentrations had decreased considerably in density and area, while in early December the quantities had dwindled to almost negligible proportions. The shape of the *Rhizosolenia* patch was more complex than usual, the effect of the south-west Dogger Bank Swirl being less pronounced than in former years. *Biddulphia sinensis*, which has for some years been found in dense concentrations in the south-west of the Southern Bight, was very sparse in that region during the autumn of 1937.

It appears very probable that the large and dense concentration of diatoms present in early October had an adverse effect on the shoaling of herring at that time, and was partly responsible for the late arrival of the shoals on the fishing grounds.

Publications.

1. Wimpenny, R. S., "The Distribution, Breeding and Feeding of some important Plankton Organisms of the South-West North Sea in 1934. Part I. *Calanus finmarchicus* (Gunn.), *Sagitta setosa* (J. Müller) and *Sagitta elegans* (Verrill)." Min. Agric. and Fish., Fish. Invest., Ser. II, Vol. XV, No. 3. 1936.
2. Savage, R. E., "The Food of North Sea Herring 1930—34." Min Agric. and Fish., Fish. Invest., Ser. II, Vol. XV, No. 5. 1937.

Plymouth.

Dr. H. W. Harvey has, during the year, finished and published part of an investigation on the occurrence of iron in sea water and its utilization by diatoms. The remaining question, whether iron in stable organic combination occurs in sea water, and can be utilized, is postponed, since Dr. Cooper's research on the dissociation of ferrous dipyridyl should lead to more certain methods of estimating the minute traces of iron expected.

Experiments, made during the course of this investigation on the part played by iron in the sea, have indicated that the growth rate of diatoms and the ability of their auxospores to develop are profoundly influenced by some substance or substances in the water other than phosphate, nitrate, silicate and available iron. The influence of a boiling water extract of soil on the growth of diatoms and of various larvae is known. The growth of the diatom *Thalassiosira* in artificial sea water was found (Allen, 1914) to require the addition of either natural sea water or an infusion of *Ulva*. Dr. Harvey has obtained evidence that the active principle of "bios" occurring in soil and in *Ulva* is an organic acid, or mixture of acids, insoluble in alcohol and ether. The ethyl ester is soluble in ether, and when this, after it had been reconverted to the acid, was added to cultures of *Ditylum Brightwelli* and *Chlamydomonas* sp., it caused

greatly increased growth. It is hoped to separate the active principle or "bios". It has properties which differ from those of α and β auxin and heteroauxin. It is stable and very resistant to bacterial decomposition and in consequence it is likely to be present in sea water.

It has also been found that cystine has a marked effect on the growth of *Ditylum*.

An experiment on the rate at which *Calanus* eat diatoms has also been made by Dr. Harvey, in order to link the results of some previous experiments with observations made subsequently by other observers. The results have now been published and the investigation is being pursued further at Woods Hole.

Mr. F. S. Russell has continued the weekly examination of ring-trawl collections with reference to the occurrence of *Sagitta elegans* and *S. setosa* and associated plankton indicators of water movements. The results for 1936 have been published, and the 1937 collections have been worked through to date. The unusual conditions as regards the *Sagitta* population noticed in 1936 have continued, both species being extremely scarce until September when *S. setosa* became abundant. The autumn of 1937 was characterized by the reappearance of *Salpa fusiformis* after a period of five years.

Miss M. V. Lebour has continued her work on lamellibranch larvae and has published an account of the larva and post-larva of *Lima hians* in the Journal of the M.B.A. A paper on prosobranch larvae has also been published in the Journal. This brings together what is known of the eggs and larvae of the British Prosobranchs with special reference to their importance in the plankton. The survey shows that our knowledge is by no means complete and many gaps have still to be filled. A very interesting new discovery is the fact that the larva of *Capulus ungaricus*, which was hatched from the egg, possesses an Echinospira larva. The Echinospira shell is much like that of *Velutina*, and it may indicate that *Capulus* is allied to the Lamellariidae and Triviinae, to which this form of larva is apparently restricted, rather than to *Calyptraea* and *Crepidula*. A paper on the larvae of *Kellia suborbicularis* is ready to be published. This mollusc is viviparous and the larvae though very minute when they are set free attain a very large size in the plankton before losing the velum, thus differing widely from those of such species as the oyster which live only a few days in the free-swimming stage. Many other lamellibranch larvae have been identified by rearing them for a time. Amongst these are *Ensis* and *Cultellus*, the larvae of which can be distinguished from one another and *Pholadidea loscombiana*, reared from artificial fertilizations until it lost the velum. The breeding seasons of many species have been ascertained, and it is noteworthy that many breed in autumn and winter.

Among the Crustacea the larvae of the two species of *Porcellana* are being specially studied as they have not as yet been distinguished. A third larva occurs in the Plymouth plankton which must belong to another species, hitherto undetected, and this is probably a *Polyonyx*. A paper on the newly hatched larva of *Spirontocaris spinus*, which differs considerably from those of related species, has been published.

Mr. Russell continued his work in collaboration with the late Mr. E. T. Browne on a monograph of British medusae and the preliminary typescripts of thirtytwo species of Anthomedusae and three species of Leptomedusae have now been completed. Attention has again been paid to the occurrence of medusae in the weekly ring-trawl catches and a paper is now in the press reviewing the medusa population in offshore waters for the last eight years, together with notes on the biology and structure of certain species. In September the early stages of the siphonophore *Muggiaea atlantica* were reared and a short account is now ready for publication.

Mr. Russell and Mr. W. J. Rees have continued their research on the rearing of hydroids from medusae. They have succeeded in rearing the hydroids of *Amphinema dinema*, *Rathkea octopunctata* and *Mitrocomella brownei*, and have found the hydroid of *Amphinema rugosum*. The results of this work have been published in the Journal.

Mr. Rees has in addition made a number of observations on other species. By rearing the medusae from *Clytia gracilis* he has shown that this species is in all propability only a variation of *Clytia johnstoni*. He has found a new species of *Campanulina* which, while itself indistinguishable from *C. acuminata*, produces medusae quite distinct from those of the latter species.

A close study has been made of the genus *Perigonimus* and in this connexion Mr. Rees went for a month to work at the Marine Biological Station at Herdla, near Bergen. The main object of this journey was to obtain *Perigonimus muscoides*, which is the genotype of the genus *Perigonimus*. He was fortunate in obtaining specimens of this species from which the medusae were liberated. The medusa proved to be a species of *Bougainvillia*, a discovery of considerable importance to nomenclature. A number of other interesting specimens was obtained including a hydroid which liberated a medusa which is possibly a new species of *Thamnostoma*. Many specimens of the hydroid *Heterostephanus annulicornis* were found liberating medusae which are almost certainly *Euphysa aurata*. Mr. Rees had previously published in the Journal of the M.B.A. an account of a young specimen of this hydroid found at Plymouth and he has since found other specimens here.

Mr. Rees received a grant from the Challenger Society to cover his expenses while working at Bergen.

France.

No report received.

Germany.

mburg.

'he Hydrobiological Department of the Zoolol Institute of Hamburg has published three ers (see below) on the plankton of Icelandic waters. survey of the area is in preparation. A fourth lication, besides advocating the plankton methods l on the "Meteor" expedition, gives a detailed cription of the sieve method now in general use almost all the latest investigations undertaken the department.

he quantitative investigations into the Baltic nkton from a lightvessel and from coastal stations, ch were started last year, will be completed in ut 18 months time; they are supplemented by erimental series from three fixed stations of the tsche Seewarte and by a series of closely spaced ples on cruises in Stettin Bay and on a voyage n Fehmarn Belt to Bornholm Deep.

n September, Professor Hentschel and Mr. K. Brandes participated as biologists in a cruise n the Patrol Vessel "Poseidon" to Bornholm Deep, er the leadership of Professor Schulz. At 43 ions, some of which were repeated, water samples l. were taken at depths of 0, 20, 40, 60, 80, and m. The analyses of the microplankton from these ples provided very significant graphs and charts, in some cases they show good correlation with hydrographic results.

blications.

TSCHEL, E., Über den Ursprung der Heringsnahrung im Norden von Island (Ber. D. Wiss. Komm. Meeresforsch., Bd. 8).

MUNDSSON, F., Das Oberflächennetzplankton der isländischen Küstengewässer nach den Ergebnissen einer Rundfahrt (Ber. D. Wiss. Komm. Meeresforsch., Bd. 8).

HKAT, A., Untersuchungen über das Herbstplankton im Bereich des Ostislandstromes (Int. Rev. Hydrobiol., in the press).

goland.

uring a cruise with the "Makrele", from 1st to March, in the German Bight surface plankton s were made at 150 stations. Simultaneous roplankton work was intended to bring to a conclusion the study that had been in progress several years on the winter distribution of the cator species in the North Sea. The following species were determined as indicators of hern waters at a position 55—100 naut. miles west rrum—Sylt: *Thysanoessa raschii*, *Th. inermis*, *Sagitta maroscelis megalops*, and *Meganyctiphanes norvegica*, the latter being found also on the southern er Ground, in List Deep, and near Helgoland. acroplankton investigations were also made during uise of the "Makrele", from 7th to 12th and to 20th May. As usual at this season, the coerates were particularly numerous. *Rathkea octopunctata* was extremely numerous sporadically, near Borkum the number being greater, perhaps much greater, than 60,000 below 1 sq. m. surface. Polyps of *Megalops haeckeli* were found on several occasions, *Bougainvillea macloviana* was again found (see Künne, Zool. Anz., Bd. 101), and *Oikopleura labradoriensis* was recorded.

An account has been published on the plankton transported into the Baltic by North Sea waters.

Plankton collected in October on a voyage of the fishery steamer "J. H. Wilhelms" to the Barents Sea is being examined. The daily plankton hauls off Helgoland have been continued.

The close connexion between hydrographic conditions and plankton was demonstrated in a report read at the meeting in Copenhagen on the distribution of surface plankton in the southern and southwestern North Sea.

Publications.

Künne, Cl., Über die Verbreitung der Leitformen des Grossplanktons in der südlichen Nordsee im Winter. (Ber. D. Wiss. Komm. f. Meeresforsch., Bd. 8. 1937).

— Über als "Fremdlinge" zu bezeichnende Grossplanktonten in der Ostsee. (Rapp. et Proc.-Verb., Vol. 102. 1937).

Holland.

No report received.

Ireland.

Routine collection of macroplankton samples by means of vertical hauls were made on the Hydrographic cruises on the North Coast in February, May and August, 1937.

Latvia.

No report received.

Norway.

University of Oslo, Botanical Laboratory.

Mrs. Karen Ringdal Gaarder, in collaboration with Dr. H. H. Gran, is preparing a report on the net plankton material from the "Michael Sars" expedition in 1910. It is expected to be ready for publication this year, and will contain descriptions of several new species of coccolithophorides and dinoflagellates.

Miss Else Fagerland is starting an investigation of the seasonal changes taking place in the phytoplankton population of a pool constructed for oyster rearing, at Flödevigen Utklekningsanstalt, in the attempt to discover the causes of the successions in phytoplankton communities within a closed water mass.

Dr. Trygve Braarud continues his study of the effect of sewage upon the general biological condi-

tions in Oslo Fjord. His report on the phytoplankton conditions in 1933—34, in collaboration with Mr. Adam Bursa, will be published this year; the material obtained in 1935—37 has not yet all been examined. This summer, in collaboration with Dr. Johan T. Ruud, Dr. Braarud intends to study the oxygen conditions in the innermost part of the fjord and to carry out some assimilation experiments. His study of the plankton algae is being carried out by means of culture experiments on diatoms.

Bergens Museum, Botanical Laboratory.

Mr. Georg Hygen is studying the physiology of the minute plankton algae from oyster pools, described by Aalvik.

See also Northern North Sea Ctee., p. 30.

Poland.

The phytoplankton material from the Gulf of Danzig was collected at 12 stations by Mr. Bursa for qualitative and quantitative research in connexion with hydrographical data (t°, $S^0/_{00}$, O_2, P, N, pH).

The data obtained in investigations of the food of sprat in Polish waters carried out by Mr. Mańkowski have been worked up and are ready for publication. The study of the seasonal occurrence o zooplankton is being continued.

Portugal.

No report received.

Scotland.

See Northern North Sea Committee Report, p 31—33.

Spain.

No report received.

Sweden.

See Transition Area Ctee Report, pp. 64—66.

Note.

The Attention is drawn also to the various Area Reports in which further details are given for some countries.

SALMON AND TROUT COMMITTEE

1937.

Prof. M. Siedlecki.

tatistical figures concerning the total yield of fishery for salmon show that the year 1937 can general be considered as a bad salmon year. In land, round Bornholm and in Finland the results fishery were exceptionally poor, in Denmark and land about mediocre, and only in Latvia an im-vement of salmon catches in comparison with ceding years was noted. In Scotland the run of ing fishes was above the average, but the catch grilse was rather poor.
The yield of fishery for sea trout was in general diocre.

Denmark (Dr. E. M. Poulsen).

Biological Investigations.

Age analyses of **salmon** by means of scales have n undertaken especially in the west Jutland rivers. report of the results (by C. V. Otterstrøm) is ng prepared. The collection of scales of salmon trout and statistics as to the weight and length Randers Fjord and the River Gudenaa have been tinued.
Marking experiments with **salmon** and **sea trout** varying ages have been undertaken especially in rs going to the North Sea.
nvestigations have been continued in water courses the amount of food available and into conditions general for fry in order to determine the optimal unt of fry to be liberated.
nformation received shows that the **sturgeon** is edingly rare in the Danish parts of the Baltic. ring the last 5 years only two small sturgeons (20 23 kg.) have been caught in the waters west of nholm; no other records of catches of sturgeon known

2. Statistics for the year 1936 (from Fiskeri-Beretning 1936, Danish Board of Fishery):

Catches in	Salmon kg.	Trout kg.
North Sea, Skagerak and the Fjords	13,116	3,525
Limfjord	0	46,126
Kattegat and the Sound	15,916	18,627
Belt Sea	4,452	15,773
Baltic	56,772	5,931
Total...	90,256	89,982

The total catch of salmon is about the same as in 1935 whereas the catch of sea trout has been somewhat smaller than in the preceding year; this is due to a strong decrease in the yield of the Limfjord trout fishery.

Estimates of the Yield of the Salmon Fisheries round Bornholm in 1937.

The yield of the spring fishery was exceedingly poor, even poorer than in the bad year 1936. Also the autumn fishery has been poor in 1937.

3. Artificial Propagation.

Output of fry in 1936 (in thousands) of sea trout in water courses leading to the	fry	half-yearlings
North Sea	790	46
Limfjord	852	22
Kattegat	886	129
Belt Sea	707	15
Western Baltic	139	
Baltic proper	868	
Total...	4,242	212

Further 48,000 tiny salmon and 5,000 half-yearlings as well as 9 million fry of *Coregonus lavaretus* were liberated in rivers leading to the North Sea.

England.

A report concerning the salmon fishery for the year 1936 has already been published (London — H. M. Stat. Office — 1937).

Finland (Prof. T. H. Järvi).

Material for scale-analysis of **salmon** was collected in Tornio, Kemi, Oulu, Kokemäki and Kymi rivers (or estuary).

The yield of the summer 1937 was very low (somewhere near half of the yield in 1936).

Tiny fry of salmon was liberated: in Tornio river 500,000, in Kemi river 853,300, in Oulu river 400,000, Kokemäki river 37,000 Kymi river 55,100 and in Paatsjoki river (Petsamo area) 50,000; the total number of salmon fry distributed was 1,895,000.

Summer-old parrs were liberated in Kemi river 24,624 and in Kokemäki river 48,500 fish; the total number of distributed parrs was 73,124.

Eggs of **Chinook-salmon**, sent from Oregon, were hatched privately: tiny fry was liberated, in Oulu river 8,900, Kokemäki river 2,000; parrs were liberated, in Oulu river 31,278 fish, in Kokemäki river 22,275 fish.

Tiny fry of **sea trout** was liberated in Norrmarkku river (Bothnian Sea): 7,600 fish.

France.

The question of salmon fishery and the measures for protection of this fish by means of fish passes are contained in a paper by M. L. Kreitmann.

A note on this is appended on page 87.

Germany.

See page 86.

Ireland (Dr. A. E. J. Went).

1. Biological Investigations.

An investigation into the stocks of **salmon** from the River Shannon in 1937 and of smolts captured over a number of years was concluded during the year, and a report on the results of this investigation is now in the press. During the year, investigations were continued on the variation of the food and growth of **brown trout** from acid and alkaline waters as typified by two selected portions of the River Liffey, and a report is now being compiled dealing with the food taken by the fish in the two environments.

2. Artificial Propagation.

During the season 1936—37 hatchery operations were successfully carried out at thirty-five stations, fifteen of which were stocked entirely with eyed ova obtained from some other hatchery, whilst the remainder were wholly or partly stocked by stripping fish taken locally for this purpose. Ova from salmon were collected by stripping at eleven hatcheries, sea trout at three hatcheries and brown trout at ten hatcheries.

The total number of fry distributed was:

Salmon fry	6,218,500
Sea Trout fry	114,750
Brown Trout fry	1,687,000
Total	8,010,250

The total number of fry distributed from all hatcheries showed an increase of more than one million over the figures for the preceding season and was the highest output recorded since the season 1927—28. All the three kinds of salmonid fish contributed to this increase. Cold weather in February and March delayed the development of ova and fry, but no damage was caused.

3. The Catch of Salmon.

The figures for the complete catch of salmon in 1937 are not available. The weight of salmon exported from Ireland, not including Northern Ireland, which usually only differs slightly from the total catch, was 525,900 kg., having a value of £ 102,039. The catch of 1937 was only 50 % of that of 1936.

The quantities exported per month, in kg. were:

January	3,050
February	46,250
March	68,150
April	103,300
May	109,800
June	111,200
July	83,900
August	9,950
September	3,000

These figures show, as compared with the preceding year, a proportional increase in the catch of spring fish and a falling off in the number of grilse.

The drift-net fishing in the sea off the north and north-west coast of Ireland was the worst since 1929.

4. Marking Experiments.

The marking of **salmon**, released after spawning at the Government's hatchery at Glenties, Co. Donegal, was continued: 206 fish having been so marked and released after stripping. Six of these fish had been marked in the hatching season 1935—36 and had returned to the River Owenea. The recaptures of eight fish which had been marked in 1936 were reported during the year, seven having been taken from the trap at the hatchery and one from a drift-net operating in Teelin Bay, Co. Donegal.

The Sturgeon.

The occurrence of the sturgeon in the waters of eland is exceedingly rare and no steps have been ken for the protection of this species.

Paper in the Press.

"The Salmon of the River Shannon". A. E. J. WENT. roc. Roy. Irish Acad., Vol. 44, Section B, 1938.

Latvia.

he Catch of Salmonidae.

The total catch of salmon and sea trout along the atvian coasts of the Baltic and the Gulf of Riga for 37 amounts to 84,000 kg. This is a further increase the catch of the previous year, 1936, (47,720 kg.), d almost reaches the average of the 14-year period 24—1936 (= 86,300 kg.). Like the fall in the preding year, the considerable rise of salmonid catches 1937 was the result of the weight of fish taken in e Gulf of Riga.

The run of salmon and sea trout in the rivers of tvia during the autumn of 1937 was much better an in 1936.

Artificial Propagation.

In the spring of 1937 the following quantities of young salmonid and coregonid fish hatched in the Government's hatcheries at Tome and Kārli were released in Latvian waters:—

Salmon:	
Daugava	772,000
Gauja	75,000
Venta	110,000
Total...	957,000
Sea Trout:	
Daugava	1,550,000
Gauja	1,160,000
Total...	2,710,000
Brook Trout:	
in various rivers	25,500
Lavaret (*C. lavaretus*):	
in various rivers	1,705,000
Whitefish (*C. generosus*):	
in various lakes	4,005,000

During the hatching season 1937/38 the following quantities of salmon and sea trout eggs were collected for cultivation at the Government's hatcheries at Tome, Kārli, and Pelči:—

	Tome	Kārli	Pelči	Total
Salmon eggs	3,330,000	546,000	150,000	4,026,000
Sea trout -	1,742,000	1,962,000	6,000	3,710,000

Eggs of Brook trout, Rainbow trout, Lavaret, and Whitefish were placed in the hatcheries as in previous years.

Catch of Salmon and Sea Trout in Latvian Coastal Waters 1937.
(in kg.)

Regions	Jan.	Febr.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total 1937
a. Coast of Vidzeme .	5	353	200	185	472	404	813	674	4,625	3,816	520	—	12,067
b. Riga coast	33	16	46	671	1,590	7,517	12,012	13,901	17,316	9,181	38	28	62,349
c. Coast of Kurzeme .	—	—	—	253	484	125	30	—	115	20	—	—	1,027
a-c. Total in the Gulf of Riga.....	38	369	246	1,109	2,546	8,046	12,855	14,575	22,056	13,017	558	28	75,443
Kolkasrags coasts...	140	—	35	317	561	10	—	40	358	713	120	135	2,429
Ventspils coasts	—	6	43	260	387	86	158	455	2,254	576	—	32	4,257
Liepāja coasts.....	474	10	9	161	397	150	—	—	17	25	191	445	1,879
. Total on the Latvian coast	652	385	333	1,847	3,891	8,292	13,013	15,070	24,685	14,331	869	640	84,008

atistics of Salmonidae Fisheries.

As in previous years, statistical data are available y for the coastal fisheries:

	1937 kg.	1936 kg.	1935 kg.
gion 1: Gulf of Riga:			
) Coast of Vidzeme...	12,060	5,150	5,870
) Riga coast.....	62,350	34,960	52,965
) Coast of Kurzeme ..	1,030	1,660	980
. a-c Total in the Gulf of Riga.....	75,440	41,770	59,815
gion 2. Kolkasrags ...	2,430	1,670	1,965
gion 3. Ventspils.....	4,260	1,995	4,960
gion 4. Liepāja	1,880	2,285	1,900
al catch of Salmonidae n the Latvian coast...	84,010	47,720	68,640

Biological Investigations.

The Fishery Laboratory of the Ministry of Agriculture continued the collection and study of material relating to the age distribution and growth-rate of salmonid fishes from the Gulf of Riga.

A number of salmon and sea trout from the Daugava and Gauja were marked.

Poland (Prof. M. Siedlecki).

1. Scientific Investigations.

As a continuation of the investigations, the results of which have been published in "Journ. du Conseil", regarding the analysis of **salmon** catches in the years from 1925 to 1933, investigations into the stock of salmon near the Polish shore were made on the basis of material collected in 1934, 1935, and 1936.

Comparison of the results of this work with the results of the investigations already published by Dr. Gunnar Alm ("The Salmon in the Baltic Precincts") shows, that the large salmon from the winter and spring catches in the southern Baltic has its origin in rivers discharging into the Gulf of Bothnia between 63°43′ and 62°29′ northern latitude.

Investigations into the nutrition of young salmon and **sea trout** in the rivers were made, and the first note on this subject has already been published. Investigations into the nutrition of **brown trout** artificially transported to the Baltic have been begun. Both investigations were connected with the studies of parasites of smolts and parrs in the Vistula.

2. Statistics of Catches in the Sea in 1937.

Salmon				Sea Trout	
Large		Small (Mielnica)			
kg.	indiv.	kg.	indiv.	kg.	indiv.
25,900	2,858	2,420	5,064	3,520	1,252

3. Marking Experiments.

A. In the river Brda the following marked fish were liberated:—

1) Salmon:
   (a) Two-year-old smolts, cultivated in ponds and hatched from eggs of salmon from Swedish rivers 694
   (b) Two-year-old smolts hatched from eggs of salmon from the River Wilia..... 1,104

2) Sea Trout:
   Two-year-old smolts hatched from eggs of Latvian sea trout..... 642

Some returns of marked fish showed that the Swedish salmon migrated to the west (one was taken near Sassnitz), but the salmon from Wilia and the sea trout migrated in the Baltic to the east and north-east from the mouth of the Vistula.

B. In the upper part of the River Vistula, 850 two-year-old smolts were liberated; in the River Dunajec 149 two-year smolts; in the River Wisłoka 524 two-year smolts; all 1523 specimens of sea trout hatched from eggs of the sea trout from Dunajec.

4. Artificial Propagation.

In the spring 1937 158,000 tiny fry of sea trout were liberated in Vistula and tributaries.

In the autumn 300,000 eggs of sea trout were put into hatcheries, 2,352 young — 14 cm. long — smolts of sea trout were liberated in the tributaries of the Vistula.

The run of sea trout in the Vistula was rather good; true salmon (*Salmo salar*) was rarely observed in that river.

Exceptionally good run of salmon (*Salmo salar*) was observed in the River Niemen, especially in Lithuanian part of that river.

Free Port of Danzig.

Official statistical figures of the catches give the results of fishery for **sea trout** only.

	Sea trout (large)	Small salmon and sea trout
January	702 kg.	51 kg.
February	287 -	14 -
March	508 -	29 -
April	534 -	548 -
May.....	465 -	243 -
June	273 -	2 -
July.....	428 -	—
August	109 -	—
September	258 -	8 -
October.....	5,168 -	151 -
November.....	13,760 -	1,268 -
December.....	11,020 -	89 -
Total...	33,512 kg.	2,403 kg.

Portugal.

The fishery for salmon being in the present circumstances very reduced, no report can be presented for this year.

Scotland (W. J. M. Menzies).

1. Stock of Salmon and Sea Trout.

The run of spring **salmon** in Scotland in 1937 was rather above the average of recent years and as usual consisted chiefly of two-winters in the sea fish. The very early run (December—February) was smaller than in seasons prior to 1920 but the numbers were very large from March to May and on parts of the east coast the run of salmon in the month of June was quite exceptional. For summer salmon (.2+) the run was not particularly good and the late run (August—September) of this age-group and of the next age-group (.3+) was distinctly poor, as has been the case in all recent years. On the east coast grilse were not quite up to the average of the last three or four years although the run was by no means poor. It is possible that there were rather more fish than the netting results indicated because a flood in July helped materially to take a proportion up the rivers beyond the netted areas.

On the west coast of Scotland, however, the run of grilse was exceptionally poor and may possibly have been one of the worst runs for the last fifty years.

his result occurred throughout the whole of the west ast and was continued down to Ireland.

For sea trout 1937 may be regarded on the east ast as an average year but in the west coast numbers re rather below the average, although the stock s by no means so poor in this area as was the case th the stock of grilse.

The nett weight of salmon and sea trout carried by il and steamer in Scotland in 1937 was 1,990,000 kg. an approximate value of Kr. 8,800,000.

Investigations of the Year-Classes of Salmon and Sea Trout.

During the year an investigation has been made of e stock of salmon running into the Solway Firth, into ich are discharged five rivers with a considerable ck in each, as well as a number of minor streams. e sample which was examined was taken from fish ught in the nets on the north shore about half way tween the open sea and the top of the Firth. At is point salmon may gather, especially during dry ather, from any of the tributary rivers and streams, d since the material consisted of 1890 fish and equate opportunity was afforded of contrasting e types of parr growth on the scales. From this last idence it appeared that while some of the fish were tives of the river situated close to the nets where e fish were taken yet a considerable proportion of e catch belonged to the two rivers running into the of the Firth, with possibly some admixture of ck from river systems further west.

In keeping with the southerly position of the district m which the material was derived, a low average gration age of smolts was found, no less than 87 r cent. being two years old and only 10 per cent. ee years of age; the remaining 3 per cent. left for sea after but a single year of freshwater feeding. outstanding feature of the smolts was their unusual e, the two- and three-year-old smolts measuring pectively 14 and 16 cm. at migration. These figures practically identical with those found in an investi- ion of material from the neighbouring River Nith, are greater, each by about 2 cm., than those nd in the Dee which lies about 35 miles to the st. The nature of the terrain through which these ious rivers flow most probably accounts for the ference, the Nith, Annan and upper Solway rivers ng more lowland in character than the rocky and orland course followed by the Dee in which the d available for parr would be expected to be less ntiful.

The catch mainly consisted of grilse and small mer fish, the spring groups being of considerably importance. Of the total catch only the exceedingly proportion of 1 per cent. was on its way to fresh er for a second time. Full details are given in a per by Mr. P. R. C. Macfarlane published by the hery Board of Scotland.

The collection of material from 1255 salmon caught the sea in the north-west coast while marking eriments were being conducted there was also examined. The chief result obtained from this work was that the scales confirmed the recaptures of the marked fish and showed that the material in question consists of fish from various rivers. Owing to the very wide differences in the type of parr scale growth in different parts of Scotland it was possible to correlate many of the fish with certain districts of the country. A further striking fact was the exceptionally high condition and good growth of the fish in 1936 which confirmed the commercial experience that grilse of that year were about 1 lb. heavier than is normally the case. Detailed results are given in a paper by Mr. G. W. Hartley published by the Fishery Board for Scotland.

For sea trout work was chiefly confined to an examination of the particulars of 1519 sea trout taken in the Conon, which flows into the top of the Cromarty Firth (Moray Firth area). This collection at first presented considerable difficulties of interpretation of the scales owing to the fact that in many instances there was no clear line of demarcation between the river and sea growth. An intermediate area suggested that the fish might spend either a final parr year in the tidal waters or remained in the Cromarty Firth for a year before proceeding out to the open ocean. Detailed investigations with a small mesh net in the locality finally showed that the scale area in doubt was formed in the tidal portion of the river and that the smolts were in these cases a year older than might have been thought to be the case. When this point had been cleared up it was found that 27 per cent. were two-year-old smolts, 68 per cent. three-year-olds and 5 per cent. four-year-olds. The parr growth was rather poor as was also their sea growth. The normal age at which spawning commences is in the second post-migration winter and the number of fish with spawning marks on their scales, 15 per cent., was relatively high in a district where nets are worked consistently throughout the season. The details of the results are in a paper by Mr. G. H. Nall which has been published by the Fishery Board for Scotland.

3. Food and Feeding Habits of Salmon and Sea Trout.

No further work has been done on this subject in 1937 but an investigation was undertaken in connexion with the physiological causes of scale absorption. This investigation took the form of an examination of the serum calcium level at different stages during the adult freshwater life of the fish. Female salmon show a progressive rise in serum calcium level until just before spawning when it drops to sub-normal and remains at the same stage when the fish is a kelt. The serum calcium in male salmon, however, remains fairly constant until just before spawning when it also drops to sub-normal. The investigation seemed to show that blood calcium is probably not derived from the scales but that the major cause of scale absorption is more probably a mineral deficiency during the migration fast.

4. Marking Experiments.

The major marking experiment undertaken in 1937 was of salmon caught in bag nets in the sea on the west coast of Scotland about 20 miles south of the position where marking was undertaken in 1936. A position close to the 1936 station was chosen in order to test the results obtained that year. The recaptures of the marked fish confirm the earlier results and show that more than half the fish which strike the coast at this point belong to rivers on the north and east coasts of Scotland as far south as the River Tay. The indications are that the fish come from the north-west in to The Minch and not from the south past the coast of Skye, but it is hoped that the position on the south side of The Minch may be examined in 1938.

Of the 448 fish marked, 13 per cent. were recaptured. The maximum distance travelled was 310 miles and the maximum rate 28 miles per day. The average speed seemed to be between 15 and 25 miles per day although owing to lack of knowledge of the time the marked fish spend at each end of their journey and of the exact route which they followed average speeds can only be an approximation, the accuracy of which is very doubtful.

5. Studies for Testing the Efficacy of Hatcheries for Salmon and Sea Trout.

No experiments regarding this have been carried out in 1937 but a programme has been elaborated for a full-scale experiment to be commenced in 1938 provided funds are forthcoming.

Sweden (Dr. Nils Rosén).

Samples of salmon scales collected during previous years from the west coast (Skagerak and Kattegat) have been examined, but the examination is not finished. Material for scale analyses of salmon has been collected at the coasts of Scania and Gothland and from the northern part of Norrland. Marking experiments with spent salmon have been undertaken in the Rivers Ume and Indal and of smolts in some rivers in Norrland. Experiments on feeding young fish under different conditions at the fish-culture stations Kvarnbäcken and Kälarna have been carried out. A report on the results has been published by G. Alm. The experiments are to be continued, especially as to the influence which warming of the water has on the hatching and the effect of impregnating eggs with sperm of mature smolts. Research work on the salmon of Vänern and on the trout of some lakes and streams has been made.

Germany.

The Seafishery Station Neukuhren of the Fishery Institute at the University of Königsberg/Pr. has continued the treatment of the analyses of the stock of salmon on the coast of Samland. The fresh-water life and the sea-life of these salmon has been subject to special attention, and the results are recorded in the following table:—

Year-class		Fresh-water life (% of salmon investigated)					Sea life (% of salmon investigated)					
Years:		1	2	3	4	5	1	2	3	4	5	6
1929/30	I	—	17·6	66·7	15·7	—	—	5·9	56·9	27·4	9·8	—
	II	—	16·2	61·7	21·3	0·8	—	12·6	53·4	24·9	8·3	0·8
	III	—	—	51·1	42·2	6·7	—	24·4	66·4	9·2	—	—
1930/31	I	—	9·5	71·4	19·1	—	4·8	59·5	21·4	11·9	2·4	—
	II	—	3·8	68·9	26·8	0·5	0·5	55·0	30·0	17·2	5·7	1·6
	III	—	6·0	63·2	29·9	0·9	1·6	53·3	30·1	11·3	3·4	0·3
1931/32	I	—	52·5	42·5	2·5	2·5	5·0	67·5	22·5	5·0	—	—
	II	—	44·2	52·6	3·2	—	0·3	53·2	40·8	4·0	1·7	—
	III	—	37·0	55·0	7·6	0·4	3·7	61·9	27·9	5·7	0·8	—
1932/33	I	1	44·6	53·4	1·0	—	2·9	37·9	50·5	6·8	1·9	—
	II	—	28·9	71·1	—	—	2·2	68·9	26·7	2·2	—	—
	III	—	29·5	69·7	0·8	—	5·3	65·9	25·0	3·0	0·8	—
1933/34	I	—	57·9	42·1	—	—	—	21·0	79·0	—	—	—
	II	—	23·6	63·1	12·9	0·4	—	46·4	50·2	3·4	—	—
	III	—	17·6	69·9	11·9	0·6	0·4	50·1	45·2	3·9	0·4	—
1934/35	I	—	14·4	46·0	21·0	18·6	13·2	40·8	40·8	5·2	—	—
	II	—	11·5	53·8	27·0	7·7	7·7	46·2	38·5	7·6	—	—
	III	—	9·1	63·6	20·0	7·3	—	60·0	36·4	3·6	—	—
1935/36	I	—	28·3	53·5	14·0	4·2	—	45·0	42·3	11·3	1·4	—
	II	—	20·0	45·4	17·3	17·3	—	25·3	53·3	17·3	1·3	2·8
	III	—	20·2	55·2	13·7	10·9	—	37·0	49·7	12·7	0·6	—

neans: Salmon caught from the beginning of the ason until the end of December, line-caught salmon; Salmon caught in January and February (by line d drift-nets), and III: Salmon investigated from the ginning of March to the end of the salmon season drift-nets).

Also, liberation of young salmon at the coast of Samland has been continued. One- and two-summer brown trout, one-summer sea trout, one-summer salmon (from the Rhine and from Latvia) and two-summer rainbow trout, were marked and liberated.

APPENDIX

By L. Kreitmann.

France.

Autrefois très abondant dans la plupart des cours au de la France tributaires de la Manche et de céan Atlantique, le saumon ne se rencontre plus quantité appréciable que dans certains cours d'eau iers (Sienne, Sée, Couesnon, Trieux, Elorn, Aulne, et, Laïta, Scorff) et dans les bassins de la Loire et l'Adour. Dans ces bassins mêmes, sa zone de répar- on se trouve fortement réduite; il a été presque ièrement éliminé du bassin secondaire de la Vienne du Gave de Pau, autrefois si riches.

Les captures annuelles de **saumon** dans les cours au de France peuvent être actuellement évaluées 6 à 7,000 individus en Bretagne et dans le départe- nt de la Manche; de 5 à 6,000 dans le bassin de la re et de 10 à 18,000 dans les Gaves et la Nive; dans autres rivières de la Manche et dans le bassin de la Garenne, elles ne se font que par individus isolés qui ne peuvent guère intervenir dans la statistique. Le rendement total des eaux françaises pourrait donc être très approximativement chiffré de 20,000 à 30,000 saumons, suivant les années. On constate d'ailleurs une très grande inégalité d'une saison à l'autre. La preuve vient encore d'en être donnée dans la seule section de cours d'eau où une statistique très précise soit tenue. Dans la partie de la Loire comprise entre la limite de la mer et l'ancienne limite de l'inscription maritime, c'est-à-dire sur une longueur de 70 kilomètres à partier de l'embouchure, on a été conduit à marquer d'un scellé à l'opercule tous les saumons capturés pendant la période exceptionelle de pêche du 15 Novembre au 10 Janvier; on a constaté 474 captures au cours de la période de 1936—1937 et 27 captures seulement pendant celle de 1937—1938.